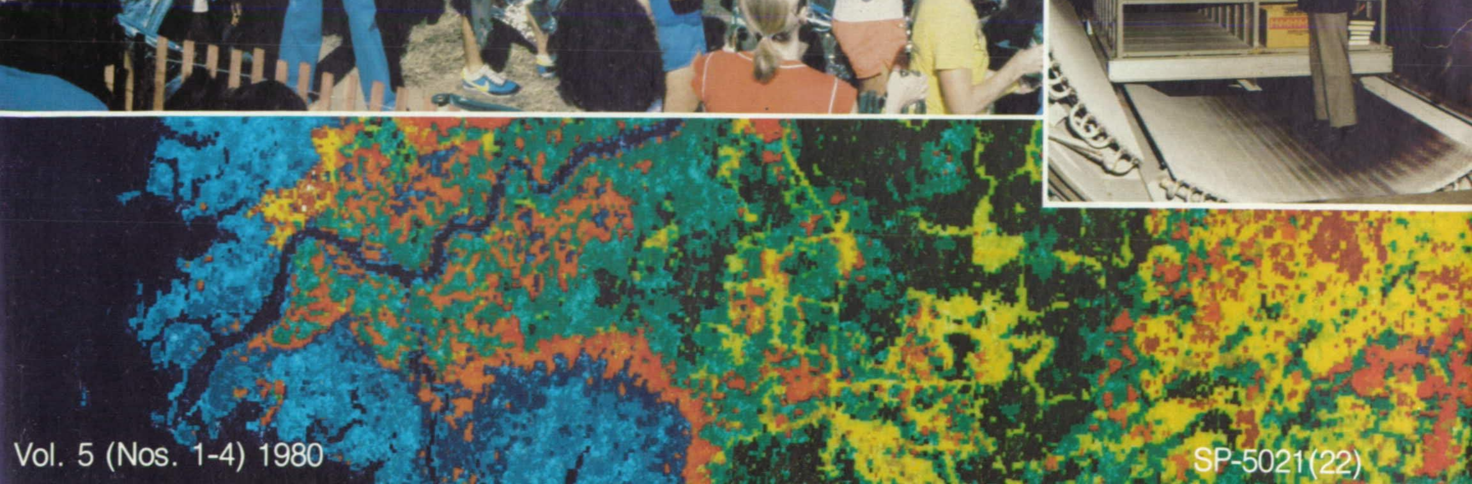
SP-5021(22)

NASA Tech Briefs Index 1980

National Aeronautics and Space Administration



Vol. 5 (Nos. 1-4) 1980

SP-5021(22)

This document is available from the National Technical Information Service (NTIS), Springfield, Virginia 22161, at price code A06 ($11.00 domestic; $22.00 Foreign). Order NASA SP-5021(22).

INTRODUCTION

Tech Briefs are short announcements of new technology derived from the research and development activities of the National Aeronautics and Space Administration. These briefs emphasize information considered likely to be transferrable across industrial, regional, or disciplinary lines and are issued to encourage commercial application.

This *Index to NASA Tech Briefs* contains abstracts and four indexes -- subject, personal author, originating Center, and Tech Brief number -- for 1980 Tech Briefs.

Abstract Section

The abstract section is divided into nine categories: Electronic Components and Circuits; Electronic Systems; Physical Sciences; Materials; Life Sciences; Mechanics; Machinery; Fabrication Technology; and Mathematics and Information Sciences. Within each category, abstracts are arranged sequentially by Tech Brief number.

A typical abstract entry has these elements:

TECH BRIEF NUMBER → B80-10133

TITLE → ADJUSTABLE BASE FOR CENTERING STAKED BEARINGS

INOVATOR → L. A. BERSON (Rockwell International Corp.)

DATE → Aug. 1980

ORIGINATING CENTER NUMBER → MSC-19660

REFERENCE IN NASA TECH BRIEF → Vol. 5, No. 1, p. 112

ABSTRACT → Adjustable base permits housing and race to be supported separately so that unequal widths can be accounted for and bearing staked on center. If race is centered and staked on flat base and housing and race are not same width, then offset may occur and bearing will be set off center.

The originating Center number in each entry includes an alphabetical prefix that identifies the NASA Center where the Tech Brief originated. A list of prefixes and the corresponding Center names are given on page iii.

Indexes

Four indexes are provided. The first is a subject index, arranged alphabetically by subject heading. Each entry in the subject index includes a Tech Brief number and a category number to aid the user in locating pertinent entries in the abstract section.

SUBJECT HEADING → AERODYNAMICS

TITLE → The design and analysis of low-speed airfoils

ORIGINATING CENTER NUMBER → LANGLEY-12727

TECH BRIEF NUMBER → B80-10524

CATEGORY → 06

The January 1976 edition of the *NASA Thesaurus* (NASA SP-7050) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA Thesaurus* should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service at $23.50 for the two-volume set.

The second index is a personal author index. Entries in this index are arranged alphabetically by author's name. Tech Brief and category numbers are supplied to help the user find the appropriate entries in the abstract section.

AUTHOR

BRAZELL, R. S.
TITLE → Applying the helium ionization detector in chromatography
MSC-18835 B80-10490 04

ORIGINATING CENTER NUMBER **TECH BRIEF NUMBER** **CATEGORY**

The third index relates each originating Center number to the corresponding Tech Brief number and category. Entries in this index are arranged in alphanumeric order by Center number.

MSC-18745 .... B80-10554 09

ORIGINATING CENTER NUMBER **TECH BRIEF NUMBER** **CATEGORY**

The fourth index relates each Tech Brief number to its originating Center number. Entries are arranged in ascending Tech Brief number order.

B80-10540 08 .... MSC-18854

TECH BRIEF NUMBER **CATEGORY** **ORIGINATING CENTER NUMBER**

Originating Center Prefixes

ARC	Ames Research Center
GSFC	Goddard Space Flight Center
HQ	NASA Headquarters
KSC	Kennedy Space Center
LANGLEY	Langley Research Center
LEWIS	Lewis Research Center
M-FS	Marshall Space Flight Center
MSC	Johnson Space Center (formerly Manned Spacecraft Center)
NPO	Jet Propulsion Laboratory/NASA Pasadena Office

Availability of NASA Tech Briefs

Distribution of *NASA Tech Briefs*, a quarterly publication, is limited to managers and engineers in U.S. Industry and to other qualified technology transfer agents, such as; members of the media, teachers, librarians, and professionals supporting domestic commerce and industry.

Requests for individual Tech Briefs or for copies of the quarterly publication should be addressed to the Director, Technology Transfer Division Office, P.O. Box 8757, Baltimore/Washington International Airport, Maryland 21240.

This document was prepared by the NASA Scientific and Technical Information Facility, operated for the National Aeronautics and Space Administration by PRC Data Services Company.

TABLE OF CONTENTS

Abstract Section

Indexes

Index to NASA Tech Briefs

June 1981

Abstract Section

01 ELECTRONIC COMPONENTS AND CIRCUITS

B80-10001
MULTIBAND MICROSTRIP ANTENNA
I. YU (Lockheed Electronics Co., Inc.)
Aug. 1980
MSC-18334 **Vol. 5, No. 1, p. 3**
Compact antenna transmits and receives elliptically and circularly polarized radiation. Antenna consists of layers of elliptical disks separated by dielectric substrates. Each disk operates at frequency determined by its size and dielectric constant of substrate. Individual frequency bands can be made to overlap, to yield single broadband antenna. Standard microstrip techniques are used to build it.

B80-10002
SIMPLE CIRCUIT MONITORS 'THIRD WIRE' IN AC LINES
T. T. KOJIMA (Rockwell International Corp.) and D. E. STUCK (Rockwell International Corp.)
Aug. 1980
M-FS-19457 **Vol. 5, No. 1, p. 4**
Device detects interruption of ground connection in three-wire electrical equipment and shuts off ac power to prevent shock hazard. Silicon-controlled rectifiers detect floating ground, and deenergize optoelectric relays thereby breaking power connections. Circuit could be incorporated into hand tools, appliances, and other electrical equipment.

B80-10003
SIMPLE BUCK/BOOST VOLTAGE REGULATOR
J. PAULKOVICH and G. E. RODRIGUEZ
Aug. 1980
GSFC-12360 **Vol. 5, No. 1, p. 5**
Circuit corrects low or high supply voltage, produces regulated output voltage. Circuit has fewer components because inductory/transformer combination and pulse-width modulator serve double duty. Regulator handles input voltage variation from as low as one half output voltage to as high as input transistor rating. Solar arrays, fuel cells, and thermionic generators might use this regulator.

B80-10004
INDEPENDENT SYNCHRONIZER FOR DIGITAL DECODERS
J. J. STIFFLER (Raytheon Co.)
Aug. 1980
MSC-16723 **Vol. 5, No. 1, p. 6**
Logic circuit synchronizes branches of any convolution code-decoder at low signal to noise ratios. Parity checks determine correct node synchronization. Device maintains synchrony as low as -3 dB. Circuit consists of 15 stage shift register, three up down counters, and some logic gates.

B80-10005
MULTICHANNEL COINCIDENCE CIRCUIT
J. I. CLEMMONS, JR.
Aug. 1980
LANGLEY-12531 **Vol. 5, No. 1, p. 7**
Digital circuit detects coincident pulses in two or more channels, and records time between primary pulses that are coincident with secondary pulses. Circuit has three major blocks: interval time subcircuit, measurement control subcircuit, and time sequence generator. Timer can be used in laser velocimeter or other instruments receiving data at irregular rates from two or more sources.

B80-10006
UNIVERSAL ODD-MODULUS FREQUENCY DIVIDER
A. ENGEL (Caltech)
Aug. 1980
NPO-13426 **Vol. 5, No. 1, p. 8**
Simple circuit divides frequency by preselected odd number. Exclusive-OR gate, divide-by-N circuit, and flip-flop are only components. Input pulses must be symmetrical.

B80-10007
DETECTING SHORT CIRCUITS DURING ASSEMBLY
G. J. DEBOO
Aug. 1980
ARC-11116 **Vol. 5, No. 1, p. 9**
Detector circuit identifies shorts between bus bars of electronic equipment being wired. Detector sounds alarm and indicates which planes are shorted. Power and ground bus bars are scanned continuously until short circuit occurs.

B80-10008
CONTINUOUS CONTROL OF PHASE-LOCKED-LOOP BANDWIDTH
G. W. MOTAL (Lockheed Electronics Co., Inc.) and J. C. VANELLI (Lockheed Electronics Co., Inc.)
Aug. 1980
MSC-16684 **Vol. 5, No. 1, p. 10**
Tracking loop filter with continuous bandwidth control smooths transition from wide to narrow band. Circuit was designed for Space Shuttle where bandwidth varied between 320 Hz for acquisition and 20 Hz for tracking. Field-effect transitor (FET) acts as voltage controlled variable resistance, changing time constant of filter between phase detector and voltage-controlled oscillator in phase-locked loop.

B80-10009
PHOTOCAPACITIVE IMAGE CONVERTER
W. E. MILLER, A. SHER (College of William and Mary), and Y. H. TSUO (College of William and Mary)
Aug. 1980
LANGLEY-12513 **Vol. 5, No. 1, p. 11**
Solid-state converters yield high sensitivity at high information-retrieval speed. Main advantages are high sensitivity of photocapacitive mechanism and inherent speed of information

retrieval method. Fabrication of both devices is relatively simple and inexpensive.

B80-10010
CROSSED-GRID CHARGE LOCATOR
D. C. HARRISON (American Science and Engineering, Inc.)
Aug. 1980
M-FS-25170 **Vol. 5, No. 1, p. 12**
Circuit locates center of cloud of charge on wire grid to within 6.5 micrometers. Wires in vicinity of charge cloud develop voltages that are processed by priority encoders to develop coarse and fine position codes. Device is used with microchannel plate amplifier in X-ray photon detectors, electron microscopes, and closed-circuit television.

B80-10011
SEMICONDUCTOR STEP-STRESS TESTING
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10012 - B80-10030
M-FS-25329 **Vol. 5, No. 1, p. 13**
Report describes extensive program to test behavior of discrete diodes and transistors subjected to power and temperature overstress. Commercially available bipolar and field effect transistors and diodes were stressed between 0.5 and 1.75 times maximum rated power. Two groups were temperature stressed: 160 hour steps starting at 75 C to maximum of 300 C. Cumulative failures and changes in device parameters were monitored and reasons for failures presented.

B80-10012
JANTX1N2970B ZENER DIODE
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011; B80-10013 - B80-10030
M-FS-25260 **Vol. 5, No. 1, p. 14**
Report evaluates effects of power and temperature overstress on General Semi-conductor and Siemens devices. Excessive failure rates limited testing. Failure modes are described.

B80-10013
JANTX1N2989B ZENER DIODE
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011; B80-10012; B80-10014; B80-10030
M-FS-25261 **Vol. 5, No. 1, p. 14**
Report evaluates effects of power and temperature overstress on General Semiconductor and Siemens devices. Mechanical disruption is prominent failure mode. Other failures are described.

B80-10014
JANTX1N3016B ZENER DIODE
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10013; B80-10015; B80-10030
M-FS-25262 **Vol. 5, No. 1, p. 14**
Report evaluates effects of power and temperature overstress on Motorola and Siemens devices. Reverse bias leakage maximum limit failure and Zener-breakdown maximum limit failure were common. Other failures are described.

B80-10015
JANTX1N3031B ZENER DIODE
Innovation not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B81-10014; B80-10016; B80-10030
M-FS-25263 **Vol. 5, No. 1, p. 14**
Report describes effects of power and temperature overstress on Motorola and Siemens diodes. Failure was predominantly due to melted metal on die connections. Other failures are described.

B80-10016
JANTX1N5622 DIODE
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10015; B80-10017; B80-10030
M-FS-25280 **Vol. 5, No. 1, p. 15**
Report describes effects of power and temperature overstress on Semtech and Micro Semiconductor diodes. Semtech devices failed with excessive reverse bias leakage due to external paint. Micro Semiconductor diodes had reverse bias leakage failure due to damaged silicon.

B80-10017
JANTX1N5623 SWITCHING DIODE
Innovator not given (Special Products Division on DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10016; B80-10018; B80-10030
M-FS-25281 **Vol. 5, No. 1, p. 15**
Report describes effects of power and temperature overstress on Semtech and Micro Semiconductor devices. Only two Semtech diodes failed catastrophically. Testing on Micro Semiconductor devices stopped because failure limit was reached. Micro diodes suffered lead separation.

B80-10018
JANTX2N2060 DUAL TRANSISTOR
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10017; B80-10019; B80-10030
M-FS-25251 **Vol. 5, No. 1, p. 15**
Report describes effects of power and temperature overstress on Motorola and Raytheon devices. Motorola devices were weak in power overstress. Raytheon devices succumbed to 160 hour temperature stress. Failure modes are detailed.

B80-10019
JANTX2N2219A DUAL TRANSISTOR
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10018; B80-10020; B80-10030
M-FS-25252 **Vol. 5, No. 1, p. 15**
Report describes effects of power and temperature overstress on Texas Instruments and National Semiconductor devices. Texas Instruments devices had only two failures in 2500 hours of testing. National Semiconductor devices reached 50% failure limit. No consistent failure mode was detected.

B80-10020
JANTX2N2369A TRANSISTOR
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10019; B80-10021; B80-10030
M-FS-25254 **Vol. 5, No. 1, p. 16**
Report describes effects of power and temperature overstress on National Semiconductor and Raytheon transistors. Good junction quality was maintained. Gain losses predominated. Other failures are reported.

B80-10021
JANTX2N2432A TRANSISTOR
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10020; B80-10022; B80-10030
M-FS-25255 **Vol. 5, No. 1, p. 16**
Report evaluates effects of power and temperature overstress on Crystalonics and Texas Instruments devices. Crystalonics devices survived better, as Texas Instruments lot exceeded 50 percent failure at 225 deg C. Failure modes are evaluated.

B80-10022
JANTX2N2484 TRANSISTOR
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10021; B80-10023; B80-10030
M-FS-25253 **Vol. 5, No. 1, p. 16**
Report evaluates effects of power and temperature overstress on Raytheon and Teledyne devices. Power overstress produced few failures. Both lots of devices exceeded 50 percent failure at 250 deg C. Failure modes are evaluated.

B80-10023
JANTX2N2605 TRANSISTOR
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10022; B80-10024; B80-10030
M-FS-25150 **Vol. 5, No. 1, p. 16**
Report evaluates effects of power and temperature overstress on Raytheon and National Semiconductor devices. Breakdown voltage hysteresis, possibly due to contamination of semiconductor by gold from leads, was prominent.

B80-10024
JANTX2N2905A TRANSISTOR
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10023; B80-10025; B80-10030
M-FS-25256 **Vol. 5, No. 1, p. 17**
Report evaluates effects of power and temperature overstress on Motorola and Texas Instruments devices. A variety of failure modes are described.

B80-10025
JANTX2N2920 DUAL TRANSISTOR
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10024; B80-10026; B80-10030
M-FS-25258 **Vol. 5, No. 1, p. 17**
Report describes effects of power and temperature overstress on Fairchild and National Semiconductor devices. 160 hour temperature stress was only test to cause notable damage. Loss of gain is principal failure mode.

B80-10026
JANTX2N2945A TRANSISTOR
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10025; B80-10027; B80-10030
M-FS-25259 **Vol. 5, No. 1, p. 17**
Report describes effects of power and temperature overstress on Raytheon and Teledyne devices. Increasing T in 16 hour steps damaged both manufacturers' lots. Raytheon lot exceeded 50 percent failure rate 160 hours before completion of test due to current gain failure. Teledyne samples completed test but had more catastrophic failures.

B80-10027
JANTX2N3637 TRANSISTOR
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10026; B80-10028; B80-10030
M-FS-25264 **Vol. 5, No. 1, p. 17**
Report describes effects of power and temperature overstress on Transitron and Motorola devices. Transitron batches exceeded 50 percent failure in power overstress and 160 hour temperature stress. Design differences are evaluated.

B80-10028
JANTX2N3811 DUAL TRANSISTOR
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10027; B80-10029; B80-10030
M-FS-25265 **Vol. 5, No. 1, p. 18**
Report evaluates effects of power and temperature overstress on Motorola and National Semiconductor devices. National Semiconductor devices exceeded 50 percent failure after 160 hours at 225 deg C. Motorola suffered more rejects but failures occurred at 300 deg C. Difference in lead bonding technique may explain performance.

B80-10029
JANTX2N4150 TRANSISTOR
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10028; B80-10030
M-FS-25267 **Vol. 5, No. 1, p. 18**
Report evaluates effects of power and temperature overstress on General Semiconductor and Transitron devices. General Semiconductor lot exceeded 50 percent failure 500 hours into 125 percent maximum rated power test. Catastrophic failure rates differed between manufacturers. Modes of failure are analyzed.

B80-10030
JANTX2N4856 FIELD-EFFECT TRANSISTOR
Innovator not given (Special Products Division of DCA Reliability Laboratory) Aug. 1980 See also B80-10011 - B80-10029
M-FS-25269 **Vol. 5, No. 1, p. 18**
Report evaluates effects of power and temperature overstress on Teledyne and Texas Instruments devices. Temperature stress caused most failures for both manufacturers' lots. Failure modes are analyzed.

B80-10149
IMPROVED POWER FACTOR CONTROLLER
F. J. NOLA
Sep. 1980 See also B77-10154; B79-10004
M-FS-25323 **Vol. 5, No. 2, p. 133**
Power dissipation is ac induction motor is reduced by circuit that lowers applied voltage when motor is idling or only lightly loaded. Timing voltages in phase with motor current are sensed a cross gate-controlled semiconductor whitch with motor, rather than across high-power resistor, as in earlier version.

B80-10150
ENERGY SAVING IN AC GENERATORS
F. J. NOLA
Sep. 1980 See also B80-10149
M-FS-25302 **Vol. 5, No. 2, p. 134**
Circuit cuts no-load losses, without sacrificing full-load power. Phase-contro circuit includes gate-controlled semiconductor switch that cuts off applied voltage for most of ac cycle if generator idling. Switch 'on' time increases when generator is in operation.

B80-10151
'PELLED-FILM' SOLAR CELLS
R. J. STIRN (Caltech)
Sep. 1980
NPO-14734 **Vol. 5, No. 2, p. 135**
Cells are lighter and less expensive than conventional cells. GaAs cells are deposited on GaAs substrate coated with thin etchable layer that allows completed cell film to be peeled away from substrate. At estimated conversion of 18 percent, array of cells delivers about 1 kW of electricity per kilogram of cell material. Blanket of cells delivers energy at power-to-weight ratio about 4 times that of conventional 2-mil (0.5-mm) silicon solar cells. GaAs solar cells have better radiation resistance than silicon cells.

B80-10152
TEMPERATURE-COMPENSATING DC RESTORER
H. M. THOMAS (Martin Marietta Corp.)
Sep. 1980
LANGLEY-12549 **Vol. 5, No. 2, p. 136**
Circuit provides stable references restoration in addition to temperature compensation. Possible TV monitor applications include traffic and security surveillance systems, where cameras are subject to environmental extremes, as in unheated warehouses or outdoors.

B80-10153
ALIASING FILTER FOR MULTIRATE SYSTEMS
J. F. L. LEE (Honeywell, Inc.)
Sep. 1980
MSC-18472 **Vol. 5, No. 2, p. 137**
Rolloff filter is inexpensive way of reducing aliasing in digital control systems. Rolloff filter operating at faster sample rate (or rates) of system with 2:1 rate ratio gives infinite attenuation at half-sample rate of fast-rate loop. Tested successfully on Space Shuttle primary flight-control systems, filter technique could be applied to other multirate sampled-data systems.

B80-10154
DUAL-FREQUENCY BIDIRECTIONAL ANTENNA
W. H. KUMMER (Hughes Aircraft Co.)
Sep. 1980
GSFC-12501 **Vol. 5, No. 2, p. 138**
Simultaneous two-way communication at 20 and 30 GHz is possible with versatile paraboloid-dish antenna. Developed for two-way communications between Space Shuttle and ground station, antenna includes parabolic reflector, feed horn, waveguide network, and single-axis gimbal mounting. System resolution and accuracy are better than 1 percent.

B80-10155
COMPUTER-CONTROLLED WARMUP CIRCUIT
J. J. DAEGES (Caltech)
Sep. 1980
NPO-14815 **Vol. 5, No. 2, p. 139**
Filament of high-power radio transmitter is brought to operating temperature automatically. Pushbotton reduces operator's role to one-step command and is compatible with various forms of computer control. Filiament shutdown is initiated by 'down' command from operator, failure of cooling systems, or power failure for more than few seconds.

B80-10156
DIRECT-CURRENT CONVERTER FOR GAS-DISCHARGE LAMPS
P. LUTUS (1LC Technology)
Sep. 1980
MSC-18407 **Vol. 5, No. 2, p. 140**
Metal/halide and similar gas-discharge lamps are powered from low-voltage dc source using small efficient converter. Converter is useful whenever 60-cycle ac power is not available or where space and weight allocations are limited. Possible applications are offshore platforms, mobile homes, and emergency lighting. Design innovations give supply high reliability and efficiency up to 75 percent.

B80-10157
POSITION MONITOR FOR MINING MACHINES
J. LUBICH (Benton Corp.)
Sep. 1980
M-FS-25342 **Vol. 5, No. 2, p. 141**
Circuit at output of incremental transducer records progress of longwall shearer. In contrast to mechanical shaft encoders, electronic circuit can be easily packaged to withstand shock and vibration of mining machine as it cuts across coal seam.

B80-10158
11-LINE TO 512-LINE DECODER
W. N. MILLER (Rockwell International Corp.)
Sep. 1980
MSC-19751 **Vol. 5, No. 2, p. 141**
CMOS decoder is assembled from standard 4-line to 16-line decoder/demultiplexer IC's. Matrix may also be used to generate 256 latched-on or latched-off logic signals instead of 512 discrete unlatched signals. By using conventional CMOS IC's, circuit consumes only about 30 milliwatts.

B80-10159
INPUT/OUTPUT INTERFACE MODULE
E. M. OZYAZICI (Rockwell International Corp.)
Sep. 1980
MSC-18180 **Vol. 5, No. 2, p. 143**
Module detects level changes in any of its 16 inputs, transfers changes to its outputs, and generates interrupts when changes are detected. Up to four changes-in-state per line are stored for later retrieval by controlling computer. Using standard TTL logic, module fits 19-inch rack-mounted console.

B80-10160
SMOOTHING THE OUTPUT FROM A DAC
C. WAGNER
Aug. 1980
FRC-11025 **Vol. 5, No. 2, p. 144**
Circuit smooths stepped waveform from analog-to-digital converter without appreciable phase shift between stepped input signal and smoothed output signal and without any effect from stepping rate. Waveform produced is suitable for driving controls used in manufacturing processes, aerospace systems, and automobiles.

B80-10161
LSI LOGIC FOR PHASE-CONTROL RECTIFIERS
C. DOLLAND (Airsearch Manufacturing Co.)
Sep. 1980
M-FS-25208 **Vol. 5, No. 2, p. 144**
Signals for controlling phase-controlled rectifier circuit are generated by combinatorial logic than can be implemented in large-scale integration (LSI). LSI circuit saves space, weight, and assembly time compared to previous controls that employ one-shot multivibrators, latches, and capacitors. LSI logic functions by sensing three phases of ac power source and by comparing actual currents with intended currents.

B80-10162
MODEL FOR MOS FIELD-TIME-DEPENDENT BREAKDOWN
S. P. LI (Caltech), J. MASERJIAN (Caltech), and S. PRUSSIN (Caltech)
Sep. 1980
NPO-14701 **Vol. 5, No. 2, p. 145**
Quantitative model for MOC breakdown is derived and correlated with experiments.

B80-10163
DDL:DIGITAL SYSTEMS DESIGN LANGUAGE
S. G. SHIVAL (Alabama Univ.)
Sep. 1980
M-FS-25352 **Vol. 5, No. 2, p. 146**
Hardware description languages are valuable tools in such applications as hardware design, system documentation, and logic design training. DDL is convenient medium for inputting design details into hardware-design automation system. It is suitable for describing digital systems at gate, register transfer, and major combinational block level.

B80-10294
ULTRASTABLE AUTOMATIC FREQUENCY CONTROL
D. J. SABOURIN (Motorola, Inc.) and A. FURIGA (Motorola, Inc.)
Jan. 1981
MSC-18679 **Vol. 5, No. 3, p. 267**
Center frequency of wideband AFC circuit drifts only hundredths of percent per day. Since circuit responds only to slow frequency drifts and modulation signal has high-pass characteristics, AFC does not interfere with normal FM operation. Stable oscillator, reset circuit, and pulse generator constitute time-averaging discriminator; digital counter in pulse generator replaces usual monostable multivibrator.

B80-10295
FAST MICROWAVE SWITCHING POWER DIVIDER
R. W. JOHNSON (Ball Corp.) and R. J. STOCKTON (Ball Corp.)
Jan. 1981
GSFC-12420 **Vol. 5, No. 3, p. 268**
Unit divides power from single input among any 12 of 120 output terminals and redistributes it in 6 microseconds. Microwave current from coaxial line excites disk feeding many radial strip transmission lines. Built for use in electronically-steered S-band antenna, device also divides and switches energy among filters and phase shifters.

B80-10296
HIGH-POWER SOLID-STATE MICROWAVE TRANSMITTER
J. D. BOREHAM (Caltech), B. L. CONROY (Caltech), R. B. POSTAL (Caltech), and D. G. YENCHE (Caltech)
Jan. 1981
NPO-14803 **Vol. 5, No. 3, p. 269**
Transmitter phases outputs from individual amplifier modules then combines them in multielement array feed antenna. Size and power capability of system are variable for radar and small-angle scanning applications.

B80-10297
ANTENNA FEED FOR LINEAR AND CIRCULAR POLARIZATION
D. A. BATHKER (Caltech) and B. L. SEIDEL (Caltech)
Jan. 1981
NPO-14810 **Vol. 5, No. 3, p. 270**
Antenna system transmits linearly-polarized microwave radio signal, yet circularly-polarized incoming signal is received without polarization-mismatch losses. Network uses only hybrid junctions, diplexer, and four-probe antenna; no waveguide switches are required. Other circuit arrangements are possible, using additional transmitters and receivers.

B80-10298
SIGNAL CONDITIONER FOR NICKEL TEMPERATURE SENSORS
R. R. WALKER (Rockwell International Corp.)
Jan. 1981
MSC-18367 **Vol. 5, No. 3, p. 270**
Simple circuit conditions output of 50 ohm sensor for readout on straingage recorder. It consists of resistors, switch, and 'matching' network. Device saves time and reduced instrumentation costs when strain and temperature are measured in same setup.

B80-10299
EFFICIENT, LIGHTWEIGHT DC/DC SWITCHING CONVERTER
S. CUK (Caltech) and R. D. MIDDLEBROOK (Caltech)
Jan. 1981 See also NASA-CR-135174(N78-29351)
LEWIS-12809 **Vol. 5, No. 3, p. 271**
Converters have input properties of boost power stage and output properties of buck power stage, yet they perform general conversion function with high efficiency. Other features include non-pulsating input/output currents, use of capacitive energy transfer, low output voltage ripple, reduced EMI, and small size.

B80-10300
28-CHANNEL ROTARY TRANSFORMER
W. T. MCLYMAN (Caltech)
Jan. 1981
NPO-14861 **Vol. 5, No. 3, p. 273**
Transformer transmits power and digital data across rotating interface. Array has many parallel data channels, each with potential I megabaud data rate. Ferrite-cored transformers are spaced along rotor; airgap between them reduces crosstalk.

B80-10301
IMPROVING MOS MINORITY-CARRIER LIFETIME
R. H. COCKRUM (Caltech), S. P. LI (Caltech), and S. PRUSSIN (Caltech)
Jan. 1981
NPO-14738 **Vol. 5, No. 3, p. 273**
Fluorine implantation increases minority-carrier lifetime in silicon by factor of 100, enhancing power efficiency in MOS applications. Implantation does not increase microdefects at silicon surface when thin oxide layers are grown, and process gathers existing impurities near surface without adversely affecting MOS electrical parameters. With these advantages, fluorine may be left on wafer surfaces after processing.

B80-10302
COOLING/GROUNDING MOUNT FOR HYBRID CIRCUITS
B. BAGSTAD (TRW, Inc.), R. ESTRADA (TRW, Inc.), and H. MANDEL (TRW, Inc.)
Jan. 1981
MSC-18728 **Vol. 5, No. 3, p. 274**
Extremely short input and output connections, adequate grounding, and efficient heat removal for hybrid integrated circuits are possible with mounting. Rectangular clamp holds hybrid on printed-circuit board, in contact with heat-conductive ground plate. Clamp is attached to ground plane by bolts.

B80-10424
ALINING SLEEVE FOR OPTICAL FIBERS
K. L. AUSTIN (Lockheed Electronics Co.)
Jan. 1981
MSC-18756 **Vol. 5, No. 3, p. 389**
Sleeve for alining two optical fibers is made with precisely correct inside diameter by using section of fiber as mandrel. Because optical fiber is manufactured to very close tolerances, diameter of section serving as mandrel will be same as diameters of two fibers that are mated in butt joint inside sleeve. Result, determined by experiments, is loss of no more that 0.3 dB at joint.

B80-10440
IMPROVED BATTERY CHARGER FOR ELECTRIC VEHICLES
W. E. RIPPEL (Caltech)
Apr. 1981
NPO-14964 **Vol. 5, No. 4, p. 411**
Polyphase version of single-phase 'boost chopper' significantly reduces ripple and electromagnetic interference (EMI). Drive circuit of n-phase boost chopper incorporates n-phase duty-cycle generator; inductor, transistor, and diode compose chopper which can run on single-phase or three-phase alternating current or on direct current. Device retains compactness and power factors approaching unity, while improving efficiency.

B80-10441
MULTIJUNCTION HIGH-VOLTAGE SOLAR CELL
J. C. EVANS, JR., C. GORADIA, and A. T. CHAI
Apr. 1981 See also NASA-TM-81389(N80-16914)
LEWIS-13400 **Vol. 5, No. 4, p. 412**
Multijunction cell allows for fabrication of high-voltage solar cell on single semiconductor wafer. Photovoltaic energy source using cell is combined on wafer with circuit it is to power. Cell consists of many voltage-generating regions internally or externally interconnected to give desired voltage and current combination. For computer applications, module is built on silicon wafer with energy for internal information processing and readouts derived from external light source.

B80-10442
SOLAR CELL IS HOUSED IN LIGHT-BULB ENCLOSURE
J. C. EVANS, JR.
Apr. 1981 See also B80-10441
LEWIS-13418 **Vol. 5, No. 4, p. 413**
Inexpensive, conventional solar-cell module uses focusing principle of electric lamp in reverse to produce electric power from sunlight. Standard outdoor light enclosure provides low-cost housing which concentrates sunlight in solar cell. Unit is capable of producing approximately 1 watt of electric power.

B80-10443
SIMPLE JFET OSCILLATOR
L. L. KLEINBERG
Apr. 1981
GSFC-12555 **Vol. 5, No. 4, p. 413**
Device used in mixers, modulators, and function generators provides stable sine-wave signal compatible with both integrated circuits and discrete-component assemblies. Oscillator's frequency is tunable over narrow band about design value. Frequency range, stability, linearity, and low power drain of device are suited to communications receivers and transmitters and digital microprocessors, computers, and displays. Circuit simplicity allows for easy monolithic construction.

B80-10444
SPEED CONTROL FOR SYNCHRONOUS MOTORS
H. PACKARD (Northrop Corp.) and J. SCHOTT (Northrop Corp.)
Apr. 1981
MSC-18680 **Vol. 5, No. 4, p. 44**
Feedback circuit controls fluctuations in speed of synchronous ac motor. Voltage proportional to phase angle is developed by phase detector, rectified, amplified, compared to threshold, and reapplied positively or negatively to motor excitation circuit. Speed control reduces wow and flutter of audio turntables and tape recorders, and enhances hunting in gyroscope motors.

B80-10445
LOW-RESISTANCE CONTINUITY TESTER

R. B. REASONER (Caltech)
Apr. 1981
NPO-14881 **Vol. 5, No. 4, p. 45**
IC printed-circuit board tester measures resistance as low as 0.1 ohm but uses little power. Two 4.7 kilohm resistors and connected transistors prevent current flow through operational amplifier until probe circuit is complete, eliminating need for on/off switch. Zener diode in series with amplifier output prevents audio oscillator operation until output has sufficient amplitude. Circuit utilizes 741 operational amplifier on 11.2 volt battery or lower voltage amplifiers.

02 ELECTRONIC SYSTEMS

B80-10031
MICROPROCESSOR-CONTROLLED DATA SYNCHRONIZER
S. W. HOUSTON (TRW, Inc.), D. R. MARTIN (TRW, Inc.), and L. R. STINE (TRW, Inc.)
Aug. 1980
MSC-18535 **Vol. 5, No. 1, p. 21**
Versatile receiver processes data at variety of rates and code formats. Functions performed are: bit detection, NRZ-L conversion, frame synchronization (with programmable word length), bit-sync acquisition and tracking, error-curve normalization, lock detection, half-bit-ambiguity resolution, and data-rate tracking.

B80-10032
VOLTAGE CONTROLLER/CURRENT LIMITER FOR AC
T. T. WU (Caltech)
Aug. 1980
NPO-13061 **Vol. 5, No. 1, p. 22**
Circuit protects ac power systems for overload failures, limits power surge and short-circuit currents to 150 percent of steady state level, regulates ac output voltage, and soft starts loads. Limiter generates dc error signal in response to line fluctuations and dumps power when overload is reached. Device is inserted between ac source and load.

B80-10033
MICROPROCESSOR CONTROL FOR PHASE-LOCK RECEIVER
L. M. CARSON (Motorola, Inc.) and J. R. SHANER (Motorola, Inc.)
Aug. 1980
NPO-14438 **Vol. 5, No. 1, p. 23**
Subsystem facilities flexible data acquisition by combining hardware and software processing. Device controls complex signal acquisition sequence and assists in precise phase locking to received signal. Key features include software system and code-generator initialization routines, executive routines, utility subroutines, control sequence routines for each receiver acquisition state, control-command decoding routine, and look-up tables for code-generator configuration versus code-set number. steps can be added to extend input signal dynamic range.

B80-10034
IMPROVED CODE-TRACKING LOOP
D. T. LAFLAME (Hughes Aircraft Co.)
Aug. 1980
MSC-18035 **Vol. 5, No. 1, p. 24**
Delay-locked loop tracks pseudonoise codes without introducing dc timing errors, because it is not sensitive to gain imbalance between signal processing arms. 'Early' and 'late' reference codes pass in combined form through both arms, and each arm acts on both codes. Circuit accommodates 1 dB weaker input signals with tracking ability equal to that of tau-dither loops.

B80-10035
MULTIPATH STAR SWITCH CONTROLLER
T. O. ANDERSON (Caltech)
Aug. 1980
NPO-13422 **Vol. 5, No. 1, p. 25**
Device concept permits parallel computers to scan several common network-connected data stations at maximum rate. Sequencers leap-frog to bypass ports already being serviced by another computer. Two-path system for 16-port star switch controller is cost effective if added bandwidth or increased reliability is desired. Triple-path system would be cost effective for 32-port controller.

B80-10036
MICROPROCESSOR-BASED DETECTOR FOR PSK COMMANDS
J. DURDEN (Motorola, Inc.) and S. W. KLARE (Motorola, Inc.)
Aug. 1980
NPO-14440 **Vol. 5, No. 1, p. 26**
Command detector unit operates over wide range of data rates and signal levels in space environment. It consists of signal conditioning, read-only memory, random-access memory, and digital processor. Entire unit fits on single multilayer printed-wiring board.

B80-10037
ONLINE ASSESSMENT OF A DISTRIBUTED PROCESSOR
L. F. EHRLICH (IBM Corp.)
Aug. 1980
KSC-11124 **Vol. 5, No. 1, p. 27**
ORT (Operational Readiness Test) software allows one engineer to test readiness of 64 minicomputers and their peripherals from single console. Software makes roll call of computers and peripherals via common data buffer to check readiness of system in morning 'wake up' or at other important times. Subsystems are tested in parallel to save time. 'Watchdog' terminates test of any system that does not respond in time, so one failed system does not halt test sequence. Entire rollcall is complete in about 15 minutes. Software is designed for Space Shuttle prelaunch checkout, but approach should interest users of similar equipment.

B80-10164
RAM-BASED FRAME SYNCHRONIZER
J. K. NISWANDER and R. J. STATTEL
Sep. 1980
GSFC-12430 **Vol. 5, No. 2, p. 149**
Frame synchronizer for serial telemetry is rapidly reconfigured for changing formats. Synchronizer generates signals marking data-word boundaries, beginning of each frame, and beginning of each paragraph. Also derived are search, check, and lock status signals. Existing unit is assembled from standard random-access memory elements and MOS and low-power-Schottky logic.

B80-10165
RAM-BASED PARALLEL-OUTPUT CONTROLLER
J. K. NISWANDER and R. J. STATTEL
Sep. 1980
GSFC-12447 **Vol. 5, No. 2, p. 150**
Selected bit strings in serial-data link are extracted for processing. Controller is programmable interface between serial-data link and peripherals that accept parallel data. It can be used to drive displays, printers, plotters, digital-to-analog converters, and parallel-output ports.

B80-10166
MICROCOMPUTER-BASED DOPPLER SYSTEMS FOR WEATHER MONITORING
P. E. SCHMID and J. J. LYNN (Old Dominion Systems, Inc.)
Sep. 1980
GSFC-12448 **Vol. 5, No. 2, p. 151**
Ground-based microcomputer determines geographical positions of beacons using Doppler data from weather satellites. System requires onnly 7 W and incorporates least-squares iteration to compute positions. Results are printed out in alphanumerics either on CRT or on teletype. 6502 CPU was used, although equivalent processor could be substituted (with appropriate modifications to hardware).

B80-10167
LINEARIZING MAGNETIC-AMPLIFIER DC TRANSDUCER OUTPUT
S. NAGANO (Caltech)
Sep. 1980
NPO-14617 **Vol. 5, No. 2, p 152**
Diode corrects nonlinearity at small currents in magnetic-amplifier dc transducer circuit.

B80-10168
BETTER-QUALITY CCD-ARRAY IMAGES
S. D. GAALEMA (Caltech)
Sep. 1980
NPO-14426 **Vol. 5, No. 2, p 153**
In quadruple sampling, signal from each element in array is sampled once before element is clamped on, twice during 'on' period, once again after element is turned off. Quadruple-sampling scheme increases overall signal-to-noise by about 40 percent above level for double sampling, prediction verified by measurements on star-tracking imager.

B80-10169
REAL-TIME FILM RECORDING FROM STROKE-WRITTEN CRT'S
R. HUNT and A. J. GRUNWALD (National Research Council)
Sep. 1980
LANGLEY-12529 **Vol. 5, No. 2, p. 154**
Real-time simulation studies often require motion-picture recording of events directly from stroke written cathode-ray tubes (CRT's). Difficulty presented is prevention of 'flicker,' which results from lack of synchronization between display sequence on CRT and shutter motion of camera. Programmable method has been devised for phasing display sequence to shutter motion, ensuring flicker-free recordings.

B80-10170
TORQUE CONTROL FOR ELECTRIC MOTORS
C. A. BERNARD (RCA Corp.)
Sep. 1980
MSC-18635 **Vol. 5, No. 2, p. 155**
Method for adjusting electric-motor torque output to accomodate various loads utilizes phase-lock loop to control relay connected to starting circuit. As load is imposed, motor slows down, and phase lock is lost. Phase-lock signal triggers relay to power starting coil and generate additional torque. Once phase lock is recoverd, relay restores starting circuit to its normal operating mode.

B80-10171
FREQUENCY-CONTROLLED VOLTAGE REGULATOR
W. T. MCLYMAN (Caltech)
Sep. 1980
NPO-13633 **Vol. 5, No. 2, p. 156**
Converting input ac to higher frequency reduce size and weight and makes possible unique kind of regulation. Since conversion frequency is above range of human hearing, supply generated on audible noise. It also exploits highfrequency conversion features to regulate its output voltage in novel way. Circuit is inherently short-circuit proof.

B80-10172
A REDUNDANT REGULATOR CONTROL WITH LOW STANDBY LOSSES
R. W. ANDRYCZYK (GE) and S. R. PECK (GE)
Sep. 1980
NPO-13165 **Vol. 5, No. 2, p. 157**
Shunt regulator circuit for outer-planet-spacecraft radioisotope thermoelectric generator minimizes power-conditioning losses. Unit consists of bank of duplicate regulator control amplifiers and their associated shunt transistors connecter across power supply line. Its high-gain circuitry arranged in redundant configuration in very reliable and is characterized by low standby loss. Circuit can be used on other power-supply applications where size, weight, and reliability are important.

B80-10173
FREQUENCY RESPONSE FO MULTIPLE-SAMPLING RATE SYSTEMS
D. K. SCHARMACK (Honeywell, Inc.)
Sep. 1980
MSC-18473 **Vol. 5, No. 2, p. 158**
Analytical procedure simplifies prediction of frequency response of multirate digital control systems. Although developed for Space Shuttle flightcontrol system, procedure is applicable to any multirate system describable by linear, constant-coefficient differential equations of difference equations.

B80-10303
COMMON DATA BUFFER
F. BYRNE
Jan. 1981
KSC-11048 **Vol. 5, No. 3, p. 277**
Time-shared interface speeds data processing in distributed computer network. Two-level high-speed scanning approach routes information to buffer, portion of which is reserved for series of 'first-in, first-out' memory stacks. Buffer address structure and memory are protected from noise or failed components by error correcting code. System is applicable to any computer or processing language.

B80-10304
SIMULTANEOUS DISK STORAGE AND RETRIEVAL
F. E. LEVINE (IBM)
Jan. 1981
KSC-11167 **Vol. 5, No. 3, p. 278**
Data are concurrently recorded on disk by one minicomputer and accessed by another, using format of memory blocks, buffering algorithm, and time-sequence addressing. Buffering algorithm works at data rates up to 68,000 words per second; modifications up rate to 160,000 words per second.

B80-10305
FOUR-QUADRANT CCD ANALOG MULTIPLIER
C. W. BROOKS (Westinghouse Electric Corp.) and D. R. LAMPE (Westinghouse Electric Corp.)
Jan. 1981 See also NASA-CR-145334(N79-14796)
LANGLEY-12332 **Vol. 5, No. 3, p. 279**
Sequential processing technique improves accuracy when CCD-array signals are multiplied by weighting function to remove offsets. System uses two schemes to cancel undesired output contributions arising from prerequisite biases. First is spontaneous cancellation by multiple 'nominally identical' devices; second is sequential cancellation where same devices are used repeatedly to form multiple products. Single device then successively subtracts products, eliminating effects of MOS-array threshold nonuniformities.

B80-10306
MONOLITHIC FOUR-QUADRANT MULTIPLIER
D. R. LAMPE (Westinghouse Electric Corp.)
Jan. 1981 See also NASA-CR-145334(N79-14796)
LANGLEY-12330A **Vol. 5, No. 3, p. 280**
Integrated configuration for 'differential' sequential processor is less susceptible to noise than one using discrete components. Accuracy of version is unaffected by sample-and-hold (S/H) acquisition speed, S/H droop rate, and stray pickup by separate card-mounted parts.

B80-10307
MONOLITHIC CCD-ARRAY READOUT
D. L. FARNSWORTH (Westinghouse Electric Corp.), D. R. LAMPE (Westinghouse Electric Corp.), and T. J. SHUTT (Westinghouse Electric Corp.)
Jan. 1981 See also NASA-CR-145334(N79-14796)
LANGLEY-12376 **Vol. 5, No. 3, p. 282**
Circuit is self-biasing, with differential current-to-voltage conversion. CMOS current-differencing readout consists of dc-balanced pair of virtual ground stages and current-differencing circuit similar to circuit mirror. Triode multiplier cell replaces test sources to form monolithic configuration. Transistors belonging to selected multiplier cell need to be duplicated for each multiplier

within correlator chip. Remaining elements form part of readout and may be scaled as single common readout stage.

B80-10308
RECEIVER ARRAY FOR HIGH-RATE TELEMETRY
M. H. BROCKMAN (Caltech) and M. F. EASTERLING (Caltech)
Jan. 1981 See also B80-10309
NPO-14579 **Vol. 5, No. 3, p. 284**

RF carrier uses two receiver systems to increase signal-to-noise ratio and sensitivity. Signals separately processed are coherently combined at summing junction for improved reception of marginal high-rate signals frequently lost to system, atmosphere, and galactic noises. Two receivers improve ratio by 2.7 dB; improvement is made by arraying more receiver systems.

B80-10309
ARRAYED RECEIVERS FOR LOW-RATE TELEMETRY
M. H. BROCKMAN (Caltech) and M. F. EASTERLING (Caltech)
Jan. 1981 See also B80-10308
NPO-14590 **Vol. 5, No. 3, p. 285**

RF carrier array includes one master and slave receiving system to improve overall signal-to-noise ratio. Greater number of slave systems creates additional improvement. Scheme reduces detection threshold of low-rate telemetry signals transmitted from spacecraft, enhancing communications efficiency.

B80-10310
COMPRESSING TV-IMAGE DATA
E. E. HILBERT (Caltech), J. LEE (Caltech), R. F. RICE (Caltech), and A. P. SCHLUTSMEYER (Caltech)
Jan. 1981
NPO-14823 **Vol. 5, No. 3, p. 286**

Compressing technique calculates activity estimator for each segment of image line. Estimator is used in conjunction with allowable bits per line, N, to determine number of bits necessary to code each segment and which segments can tolerate truncation. Preprocessed line data are then passed to adaptive variable-length coder, which selects optimum transmission code. Method increases capacity of broadcast and cable television transmissions and helps reduce size of storage medium for video and digital audio recordings.

B80-10311
REAL-TIME IMAGE ENHANCEMENT
V. S. WONG (Caltech)
Jan. 1981
NPO-14281 **Vol. 5, No. 3, p. 287**

Pipelined system with 'vision' algorithm is implemented on LSI chip that processes input digital image data to produce image-edge map. System contains 3 input adder, difference and absolute value cells, and adder and comparator. Data store for 1 to 2 ms, and are easily transmitted or isolated; design has reduced package count and number of interconnections for increased reliability. Applications include locating objects on moving belt, deep-sea and coal mining, and control of robotic rovers.

B80-10312
TOGGLED SIGNAL FOR PREVENTION OF CONTROL ERRORS
C. E. WYLLIE (Honeywell, Inc.)
Jan. 1981
MSC-18779 **Vol. 5, No. 3, p. 288**

Redundant command lines use two different 'true' signals to avoid common failure modes. When function is required to operate, computer generates command and transmits it to demultiplexer, where it is split along two paths, producing outputs from separate electronic cards. Outputs combine to drive and gate high and begin function.

B80-10313
CONVERTING A DIGITAL FILTER TO ITS ANALOG EQUIVALENT
J. F. L. LEE (Honeywell, Inc.)
Jan. 1981
MSC-18587 **Vol. 5, No. 3, p. 289**

Two complementary methods for conversion are direct conversion method and inverse of Tustin's method. Required accuracy of filter is achieved using best-matched technique. Both require only direct computations and are simpler and more efficient than conventional iterative systems or methods requiring 'ad hoc' filter parameter adjustment.

B80-10314
AIRBORNE METEOROLOGICAL DATA-COLLECTION SYSTEM
J. W. BAGWELL and B. G. LINDOW
Jan. 1981 See also NASA-TM-78992(N78-33283)
LEWIS-13346 **Vol. 5, No. 3, p. 290**

Aircraft position and weather data are collected, formatted, and relayed to ground from in-flight commercial jets. Data Acquisition and Control Unit in plane receives information from standard avionics data units, and provides scaling and storage. Normally, eight sets of data are acquired in 1 hour period and transmitted to satellite at precise time. Besides meteorological applications, system can locate and reroute aircraft into favorable winds to conserve fuel or aid search for downed planes.

B80-10315
RECEIVING SIGNALS OF ANY POLARIZATION
J. E. OHLSON (Caltech), B. L. SEIDEL (Caltech), and C. H. STELZRIED (Caltech)
Jan. 1981 See also B80-10297
NPO-14836 **Vol. 5, No. 3, p. 291**

Two-channel detection accommodates linear, circular, and elliptical polarization in one receiving unit. Receiver employs orthomode transducer which breaks any type signal into one left and one right circular component. These are processed in separate receiver channels with equal time-delay, and then recombined for data extraction. System eliminates losses due to polarization mismatch.

B80-10316
PORTABLE ZERO-DELAY ASSEMBLY
M. M. FRANCO (Caltech), T. Y. OTOSHI (Caltech), and E. J. SERHAL, JR. (Caltech)
Jan. 1981
NPO-14671 **Vol. 5, No. 3, p. 292**

Instrument is calibrated using back-to-back method. In comparison standard, S-X isolators are opposite from device being tested to permit signal flow in reverse direction. After calibration portable zero-delay assembly (PZDA) is used to set time delays of deep-space network ground-station ranging systems. Approach is also used to calibrate microwave links in other communications systems.

B80-10317
PHOTOMETER USED FOR RESPONSE TIME MEASUREMENT
A. J. DA SILVA
Jan. 1981
MSC-18712 **Vol. 5, No. 3, p. 293**

Photometer detects motion for measuring response speed and acceleration of servocontrol system. Instrument senses selected output movement shortly after operator activates hand-controlled input. Time delay is measured on X/T recorder and response calculated. With suitable motion targets, photometer measures any open- or closed-loop servoresponse and servorate or computer lag without system disturbance.

B80-10446
SUPERCONDUCTING GYROCON WOULD BE VERY EFFICIENT
H. C. YEN (Caltech)
Apr. 1981
NPO-14975 **Vol. 5, No. 4, p. 419**

Cryogenic operation of gyrocon increases gain by more than 35 dB and efficiency by 90 percent. Device consists of electron gun, deflection cavity, output cavity, collector, and output coupler. Input and output cavities are made of superconducting lead or niobium. Gyrocon operates at frequencies up to 50 GHz.

B80-10447
HIGH-POWER DUAL-DIRECTIONAL COUPLER
T. Y. OTOSHI (Caltech) and K. B. WALLACE (Caltech)
Apr. 1981
NPO-14713 **Vol. 5, No. 4, p. 420**
Water-cooled coupler installed in S-band polarization diversity (SPD) cone is used to calibrate receiving-station relay. Coupler operates without arcing at 400 kw and permits accurate calibration of entire system below antenna feed horn. Device has good directivity, contributes less than 0.01 K to system noise temperature, and eliminates saturation of ground station and spacecraft receivers during high-power operation.

B80-10448
CAVITY-BACKED SPIRAL-SLOT ANTENNA
H. ELLIS, JR. (Rockwell International Corp.)
Apr. 1981
MSC-18532 **Vol. 5, No. 4, p. 421**
Compact, rugged, flush-mounted antenna operates in sum or difference modes with circular polarization. Radiating elements consist of two pairs of centerfed, interleaved spiral slots in conductive aperature plane. At center feedpoint of each slot pair is balanced feed assembly. Center points are fed from split-tube coaxial balun passing through quarter-wave length deep cavity. Circularly polarized patterns represent both rceived and transmitted signals.

B80-10449
TIMING SIGNAL PROPAGATES WITHOUT PHASE SHIFT
A. V. KANTAK (LinCom Corp.) and W. C. LINDSEY (LinCom Corp.)
Apr. 1981
MSC-18777 **Vol. 5, No. 4, p. 422**
Continous monitoring of transmission delay corrects for phase shift. Nodes in Master/Slave Returnable Timing System (MSRTS) are arranged in hierarchy, with each node serving as master to several slave nodes. As signal at each slave is synchronized with original master, it serves as master to synchronize following slave nodes. System improves performance of phased microwave antenna arrays in solar-powered satellites and clock distribution systems in avionics and computers.

B80-10450
TRISLOT-CAVITY MICROSTRIP ANTENNA
H. ELLIS, JR. (Rockwell International Corp.)
Apr. 1981
MSC-18793 **Vol. 5, No. 4, p. 422**
Flush-mountable assembly composed of disk radiator sandwiched between planes of metal-clad dielectric board has greater bandwidths and beamwidths than simple disk antenna. Conducting planes connect so that disk is enclosed in cavity with Y-shaped slot in top plane. Cavity is excited by microwave energy from disk and radiates from trislot aperature.

B80-10451
DEVELOPING EXPERIMENT INSTRUMENT PACKAGES
R. HERREID
Apr. 1981
GSFC-12536 **Vol. 5, No. 4, p. 423**
Ground-Support Equipment (GSE) system supports development, calibration, and testing of experiment packages. It is also used for 'quick look' processing and in-progress data analysis. User interacts with incoming telemetry data, performs computations, and controls execution of procedures using versatile Experiment Command Interactive Language (ECIL). Program is implemented many ways with minimal modification. It is written in MARCO II and FORTRAN for DEC PDP-11/34 using the RSX-11M operating system.

03 PHYSICAL SCIENCES

B80-10038
PHOTOELECTROCHEMICAL CELL WITH NONDISSOLVING ANODE
A. B. ELLIS (MIT), S. W. KAISER (MIT), and M. S. WRIGHTON (MIT)
Aug. 1980
LANGLEY-12591 **Vol. 5, No. 1, p. 31**
Improved electrolytic cells have efficiencies comparable to those of best silicon solar cells but are potentially less expensive to manufacture. Cells consist of light-sensitive n-type semiconductor anode and metallic cathode immersed in electrolytic solution. Reversible redox cells produce no chemical change in electrolyte and stabilize anode against dissolving. Cell can produce more than 500 mW of power per square centimeter of anode area at output voltage of 0.4 V.

B80-10039
NEW MOUNTING IMPROVES SOLAR-CELL EFFICIENCY
N. F. SHEPARD, JR. (General Electric Co.)
Aug. 1980
NPO-14467 **Vol. 5, No. 1, p. 32**
Method boosts output by about 20 percent by trapping and redirecting solar radiation without increasing module depth. Mounted solar-cell array is covered with internally reflecting plate. Plate is attached to each cell by transparent adhesive, and space between cells is covered with layer of diffusely reflecting material. Solar energy falling on space between cells is diffused and reflected internally by plate until it is reflected onto solar cell.

B80-10040
ENERGY-SAVING THERMOSTAT
R. N. JENSEN
Aug. 1980
LANGLEY-12450 **Vol. 5, No. 1, p. 33**
Thermostat for two-stage heating system adjusts turn-on time and thermostat setpoint so that reserve resistance electrical heaters are not activated in morning warm up. Thermostat monitors outside temperature and turns on heat earlier in cold weather so that room will be at desired temperature by specified time. Mechanical, electrical, electronic, pneumatic, or microprocessor versions of device are possible. Correctional factors can be included where second-stage operation is more cost-effective than prolonged first-stage operation.

B80-10041
ROTATABLE PRISM FOR PAN AND TILT
W. B. BALL
Aug. 1980
LANGLEY-12388 **Vol. 5, No. 1, p. 34**
Compact, inexpensive, motor-driven prisms change field of view of TV camera. Camera and prism rotate about lens axis to produce pan effect. Rotating prism around axis parallel to lens produces tilt. Size of drive unit and required clearance are little more than size of camera.

B80-10042
ULTRAVIOLET SPECTROMETER/POLARIMETER
Innovator not given (Brown Engineering of Teledyne Industries, Inc.) Aug. 1980
M-FS-25298 **Vol. 5, No. 1, p. 34**
Improved satellite instrument package consists of telescope, spectrometer with polarimeter, five detectors, and control electronics. Instrument is designed to study solar ultraviolet radiation. Polarimeter will determine four Stokes parameters and possible mechanisms for producing linear and circular polarization. Density measurements of Earth's upper atmosphere constituents are possible.

B80-10043
AN ADJUSTABLE SOLAR CONCENTRATOR
E. R. COLLINS, JR. (Caltech)
Aug. 1980
NPO-14710 **Vol. 5, No. 1, p. 35**
Fixed cylindrical converging lenses followed by movable parabolic mirror focus solar energy on conventional linear collector.

System is low cost and accommodates daily and seasonal movements of the sun. Mirrors may be moved using simple, low-power electrical motors.

B80-10044
LARGE-VOLUME MULTIPLE-PATH NUCLEAR-PUMPED LASER
F. HOHL and R. J. DE YOUNG (Miami Univ.)
Aug. 1980
LANGLEY-12592 **Vol. 5, No. 1, p. 36**
Output of nuclear pumped laser is increased using mirrors, so multiple optical reflections enlarge lasing-mode volume. Design requires comparatively low thermal neutron flux, uses flux more efficiently. Flux for lasing approaches that available from steady-state reactor. Outputs over 100 watts have been reached.

B80-10045
EXTRACTING ENERGY FROM NATURAL FLOW
L. M. DELIONBACK and G. A. WILHOLD
Aug. 1980
M-FS-23989 **Vol. 5, No. 1, p. 37**
Three concepts for extracting energy from wind, waterflow, and tides utilize flow instability to generate usable energy. Proposed converters respond to vortex excitation motion, galloping or plunging motion, and flutter. Fluid-flow instability is more efficient in developing lift than is direct flow.

B80-10046
TWELVE SOLAR-HEATING/COOLING SYSTEMS: DESIGN AND DEVELOPMENT
Innovator not given (Energy Resources Center of Honeywell, Inc.) Aug. 1980
M-FS-25358 **Vol. 5, No. 1, p. 38**
Two quarterly reports describe first 6 months of development on single family, multifamily, and commercial installations in Minneapolis area. Reports discuss basic requirements, and reasons for selecting specific configurations. Systems consist of liquid cooled flat plate collectors, two fluid loops, and gas-fired forced-air auxiliary heat source.

B80-10047
SOLAR-HEATING AND COOLING SYSTEM DESIGN PACKAGE
Innovator not given (Solaron Corp.) Aug. 1980
M-FS-25393 **Vol. 5, No. 1, p. 38**
Package of information includes design data, performance specifications, drawings, hazard analysis, and spare parts list for commercially produced system installed in single-family dwelling in Akron, Ohio. System uses air flat-plate collectors, 12000 kg rock storage and backup heat pump. Solar portion requires 0.7 kW, and provides 35% of average total heating load including hot water. Information aids persons considering installing solar home-heating systems.

B80-10048
BENEFIT ASSESSMENT OF SOLAR-AUGMENTED NATURAL GAS SYSTEMS
E. S. DAVIS (Caltech), R. L. FRENCH (Caltech), and R. L. SOHN (Caltech)
Aug. 1980
NPO-14568 **Vol. 5, No. 1, p. 38**
Report details how solar-energy-augmented system can reduce natural gas consumption by 40% to 70%. Applications discussed include: domestic hot water system, solar-assisted gas heat pumps, direct heating from storage tank. Industrial uses, solar-assisted appliances, and economic factors are discussed.

B80-10049
AIR-COOLED SOLAR-COLLECTOR SPECIFICATION
Innovator not given (Owens-Illinois, Inc.) Aug. 1980
M-FS-25336 **Vol. 5, No. 1, p. 39**
Report summarizes performance specifications of 72-element, concentric-tube collector. Chart shows minimum collector efficiency as function of operating conditions.

B80-10050
INDOOR TESTS OF THE CONCENTRIC-TUBE SOLAR COLLECTOR
Innovator not given (Solar Energy Systems Division of Wyle Laboratories) Aug. 1980
M-FS-25390 **Vol. 5, No. 1, P. 39**
Report describes performance tests on 12-tube, liquid-filled collector. Thermal efficiency, change in efficiency with sun position, and time constant for temperature drop after solar flux is cut are described.

B80-10051
EVACUATED-TUBE SOLAR COLLECTOR-PERFORMANCE EVALUATION
Innovator not given (Wyle Laboratories) Aug. 1980
M-FS-25339 **Vol. 5, No. 1, p. 39**
Report gives thermal performance test procedures and results for commercially produced, water-filled, 8-tube collectors. Tests include efficiency, time constant for temperature drop after solar flux is cut, change in efficiency as function of sun angle, and test to see if tubes break when filled with hot water.

B80-10052
GLYCOL/WATER EVACUATED-TUBE SOLAR COLLECTOR
Innovator not given (Wyle Laboratories) Aug. 1980
M-FS-25337 **Vol. 5, No. 1, p. 40**
Report describes performance of 8 tube and 10 tube commercially produced solar collectors. Tests include thermal efficiency, time constant for temperature drop after solar flux is cut, change in efficiency with Sun angle, and temperature rise if circulation is stopped.

B80-10053
THERMOSYPHON HEAT EXCHANGER
J. D. HANKINS
Aug. 1980
M-FS-25389 **Vol. 5, No. 1, p. 40**
Report summarizes final development, testing, and certification of pumpless, liquid-to-air heat exchanger for solar heating. System requires blower but no pump in water loop. Output is 35,000 Btu/hr when water temperature is 49 C.

B80-10054
CONTROLLER FOR SOLAR-ENERGY SYSTEMS
J. D. HANKINS
Aug. 1980
M-FS-25386 **Vol. 5, No. 1, p. 40**
Report describes operation and testing of computerized control unit for solar-heating and cooling systems. Unit includes electronics and 'plumbing'. Components are modular. Microprocessor with ROM and RAM operates fans, pumps, and valves, and retains selected data for 32 hours.

B80-10055
CONTROLLER AND TEMPERATURE MONITOR FOR SOLAR HEATING
J. D. HANKINS
Aug. 1980
M-FS-25387 **Vol. 5, No. 1, p. 41**
Report describes development and certification of 77-171 differential thermostat for controlling solar-heating and cooling systems and 77-180 temperature monitor of indoor, outdoor, and storage temperatures. Units are commercially available.

B80-10056
INHIBITING CORROSION IN SOLAR-HEATING AND COOLING SYSTEMS
G. E. DERAMUS, JR. and T. S. HUMPHRIES
Aug. 1980
M-FS-25387 **Vol. 5, No. 1, p. 41**
Report describes evaluation of 12 water additives in contact with aluminum, copper, steel, and stainless steel at 80 C for one year. Several promising formulations were found.

B80-10057
NUMERICAL TRACING OF ELECTRON TRAJECTORIES

T. N. DELMER (Science Applications, Inc.) and T. C. STEPHENS
Aug. 1980
GSFC-12535 **Vol. 5, No. 1, p. 41**
Computer program integrates path of relativistic electron through region of nonuniform static electromagnetic fields with accuracy of 1 micrometer in 10 centimeters. Program can be used to evaluate and modify design of electron-imaging systems. Language is FORTRAN IV, for batch or interactive execution on PDP 10, 11, CYBER 70, 170, and CDC 6000.

B80-10058
NASA CHARGING ANALYZER PROGRAM
J. J. CASSIDY, III (Systems, Science & Software), J. M. HARVEY (Systems, Science & Software), I. KATZ (Systems, Science & Software), and M. J. MANDELL (Systems, Science & Software)
Aug. 1980
LEWIS-12973 **Vol. 5, No. 1, p. 42**
Computer program predicts electrostatic charging of three dimensional, conducting object partially or completely covered with dielectric films. Program is useful in describing spacecraft charging and material accumulation in plasma environment of magnetosphere. Numerous graphic outputs are implemented. Language is FORTRAN V, for batch execution on 1100-series computer.

B80-10174
AN EQUATION OF STATE FOR LIQUIDS
R. F. FEDORS (Caltech), R. F. LANDEL (Caltech), and J. MOACANIN (Caltech)
Sep. 1980
NPO-14821 **Vol. 5, No. 2, p. 161**
Closed expression for volume as function of pressure and temperature has been verified for over 250 liquids. Equation can assist chemical engineers, soild-state researchers, and others with interest in thermodynamic behavior of liquids.

B80-10175
HIGH-RESOLUTION SPECTROMETRY/INTERFEROMETER
J. B. BRECKINRIDGE (Caltech), R. H. NORTON (Caltech), and R. A. SCHINDLER (Caltech)
Sep. 1980
NPO-14448 **Vol. 5, No. 2, p. 162**
Modified double-pass interferometer has several features that maximize its resolution. Proposed for rocket-borne probes of upper atmosphere, it includes cat's-eye retroreflectors in both arms, wedge-shaped beam splitter, and wedged optical-path compensator. Advantages are full tilt compensation, minimal spectrum 'channeling,' easy tunability, maximum fringe contrast, and even two-sided interferograms.

B80-10176
INSTRUMENT REMOTELY MEASURES WIND VELOCITIES
J. S. MARGOLIS (Caltech), D. J. MCCLEESE (Caltech), C. H. SEAMAN (Caltech), and M. S. SHUMATE (Caltech)
Sep. 1980
NPO-14524 **Vol. 5, No. 2, p. 163**
Doppler-shift spectrometer makes remote satellite measurements of atmospheric wind velocity and temperature at specified altitudes. As in correlation spectrometer, spectrum of gas in reference cell and spectrum of same gas in atmosphere are correlated both in emission and absorption.

B80-10177
FAR-FIELD RADIATION PATTERN OF TUNABLE DIODE LASERS
T. J. LASH
Sep. 1980
LANGLEY-12631 **Vol. 5, No. 2, p. 164**
Technique rapidly determines far-field spatial energy distribution. Method takes about 3 minutes. It is optically simple and is economical, using standard laboratory parts and equipment. It records automatically without operator control and is easily adaptable to computer control of input instructions and computer treatment of output data. Degree of data resolution is limted only by width of recorder pen, and data are repeatable.

B80-10178
OPTICAL CALIBRATOR FOR TDL SPECTROMETERS
D. E. JENNINGS
Sep. 1980
GSFC-12562 **Vol. 5, No. 2, p. 164**
Two etalons and monochromator mode selector help calibrate spectrometer in selected laser mode. Technique accurately determines free spectral range of etalon. By establishing number of fringes between two modes, both of which have been calibrated with molecular line standards, one finds free spectral range with error inversely proportional to spectral interval between calibration points. Procedure establishes free spectral range of etalon without prior knowledge of its length or refractive index.

B80-10179
UV ACTINOMETER FILM
C. D. COULBERT (Caltech), A. GUPTA (Caltech), and J. PITTS (California Univ., Riverside)
Sep. 1980
NPO-14479 **Vol. 5, No. 2, p. 165**
Cumulative UV radiation can be measured by low-cost polymer film that is unaffected by visible light. Useful for virtually any surface, film can help paint and plastics manufacturers determine how well their products stand up against UV radiation. Actinometer film uses photochemically sensitive compound that changes its chemical composition in response to solar radiation. Extent of chemical conversion depends on length exposure and can be measured by examining film sample with spectrophotometer. Film can be exposed from several seconds up to month.

B80-10180
FLUORESCENT RADIATION CONVERTER
W. VIEHMANN
Sep. 1980
GSFC-12528 **Vol. 5, No. 2, p. 166**
Fluorescent radiation converter used optically transparent substrate. One side of substrate is coated with plastic film containing fluorescent organic dyes that absorb optical radiation at one wavelength and emit it at longer one. Coating is formulated to respond to specific wavelengths. Emitted radiation is reflected internally inside substrate, amplifying intensity that reaches radiation detector. Converter can be made in several shapes and size; round and square bars coated all round their lengths are useful in converting relatively intense radiation and transmitting it through substrate over lengthy distances.

B80-10181
AUTOMATED HOLOGRAPHIC DROP-SIZE ANALYZER RPN NPO-14676
S. P. FEINSTEIN (Caltech) and M. A. GIRARD (Caltech)
Sep. 1980 **Vol. 5, No. 2, p. 166**
System analyzes drop-size distribution in liquid-droplet-spray combustion fields. Holographic camera takes 'stop-motion' hologram of combustion volume; it is then viewed by vidicon camera connected to digital data-processing system that identifies particles or droplets, determining their size and count, and displays histogram of drop-size distribution in holographic field.

B80-10182
PHOTOGRAPHIC MEASUREMENT OF DROPLET DENSITY
W. C. YAGER (GE)
Sep. 1980
M-FS-25326 **Vol. 5, No. 2, P. 167**
Density of cloud droplets in expansion chamber or static diffusion liquid chamber is measured with error of less than 3 percent by improved photographic technique. Precision is substantial advance over 10 percent accuracy limitation in methods used in past. Method should be useful in pollutant analysis, fine-particle research, and aerosol studies.

B80-10183
CAMERA ADD-ON RECORDS TIME OF EXPOSURE
E. C. COMPTON, P. C. KASSEL, JR., and C. W. KNIGHT
Sep. 1980
LANGLEY-12635 **Vol. 5, No. 2, p. 168**
Time photograph is taken and is permanently recorded on

edge of exposure by compact electronics module that attaches to camera case. Single-chip timing circuit drives LED display, which is imaged on film plane. Normally blanked display is unblanked when shutter switch is activated.

B80-10184
IMPROVED MULTISPECTRAL SOLAR CELL ARRAY
J. J. REDMANN (The Aerospace Corp.)
Sep. 1980
HQN-10937 **Vol. 5, No. 2, p. 169**
Solar-collector system projects oval-shaped color-band images onto solar cells designed to be most efficient at specific wavelength. Image size can be altered by changing width of reflecting mirror of power of lens. Image intensity is thus kept at optimum level, preventing cells from overheating.

B80-10185
LOW-COST CALIBRATION OF ACOUSTIC LOCATORS
R. F. BERRY
Sep. 1980
LANGLEY-12632 **Vol. 5, No. 2, p. 169**
Method uses modified commercially-available piezoelectric-torch lighter. Handheld lighter has controlled spark gap that can be easily adjusted to produce repeatable short-duration high-amplitude voltage spikes. Pulser and lighter are coupled via short axial cable, eliminating long cable run variations in cable attenuation, and problem with cable entangling with anything in its path.

B80-10186
INTEGRAL STORAGE-BULB AND MICROWAVE CAVITY FOR MASERS
V. S. REINHARDT
Sep. 1980
GSFC-12542 **Vol. 5, No. 2, p. 170**
Mechanically-stable integral storage-bulb/microwave cavity made out of single piece of fused quartz improves frequency stability. Single-piece construction eliminates joints, making cavity dimensionally and hence frequency-stable. Fused quartz is used because of its low thermal expansion coefficient.

B80-10187
A SURVEY OF PHOTOVOLTAIC SYSTEMS
Innovator not given (Alabama Univ.) Sep. 1980
M-FS-25397 **Vol. 5, No. 2, p. 171**
Results of extensive telephone survey of photovoltaic manufacturers are compiled in 220 page report. Three part report includes catalog of suppliers, data sheets on specific products, and typical operating, installation, and maintenance procedures.

B80-10188
THERMAL STRATIFICATION IN LIQUID STORAGE TANKS
D. L. CHRISTENSEN (Alabama Univ.) and S. M. HAN (Alabama Univ.)
Sep. 1980
M-FS-25416 **Vol. 5, No. 2, p. 171**
Comprehensive literature survey indicates thermal stratification in solarenergy/liquid-storage tank improves system performance by as much as 15 percent. Collector efficiency increases when collector inlet fluid is drawn from bottom of storage tank, where fluid is coolest; warmest liquid drawn top of tank to satisfy thermal load.

B80-10189
FINAL REPORT ON DEVELOPMENT OF A PROGRAMABLE CONTROLLER
J. D. HANKINS
Sep. 1980 See also B78-10183
M-FS-25388 **Vol. 5, No. 2, p. 172**
Microprocessor-based controller for solar-heating and cooling systems is described in report. Analog data from flow sensors, temperature sensors, and other devices are accepted by programable controller. It also receives digital input from relays and switches. Report describes background of development program. It also summarizes operation, performance, and applications of controller.

B80-10190
FRESNEL LENS TRACKING SOLAR COLLECTOR
Innovator not given (Solar Energy Systems Div. of Wyle Laboratories) Sep. 1980 See also B79-10061
M-FS-25419 **Vol. 5, No. 2, p. 172**
Commercial tracking collector that uses acrylic Fresnel lenses to focus Sunlight on copper absorber tubes was evaluated. Tests are documented in 16 page report.

B80-10191
OUTDOOR TESTS OF THE CONCENTRIC-TUBE COLLECTOR
Innovator not given (Wyle Laboratories) Sep. 1980 See also B80-10050
M-FS-25398 **Vol. 5, No. 2, p. 172**
Seventy two element, air-filled version of concentric-tube solar collector recently underwent 2 month performance evaluation at Marshall Space Flight Center solar house. Summary of results, along with other relevant data, is presented in 27 page report.

B80-10192
SELECTIVE OPTICAL COATINGS FOR SOLAR COLLECTORS
J. R. LOWERY
Sep. 1980
M-FS-23589 **Vol. 5, No. 2, p. 173**
For best performance, energy-absorbing surface of solar collector should be characterized by high ratio of solar absorptance to thermal emitance. Report on optical characteristics of several chemical treatments and electrodeposited coatings for metal solar-absorbing surfaces should interest designers and users of solar-energy systems. Moisture resistance of some coatings is also reported.

B80-10193
FINNED-ABSORBER SOLAR COLLECTOR
Innovator not given (Solar Energy Systems Div. of Wyle Laboratories) Sep. 1980
M-FS-25385 **Vol. 5, No. 2, p. 173**
Report presents results of performance evaluation. Tests are part of continuing study of solar-heating systems and components for NASA and Department of Energy. Test data are presented as graphs and tables. Report also summarizes test procedures and mathematical analysis of results.

B80-10194
A TEST PROGRAM FOR SOLAR COLLECTORS
Innovator not given (Energy Resources Center of Honeywell, Inc.) Sep. 1980 See also B79-10059
M-FS-25433 **Vol. 5, No. 2, p. 173**
Rigorous environmental and performance tests qualify solar collector for use in residential solar-energy systems. Testing over 7 month period examined pressurized effects, wind and snow loading, hail damage, solar and thermal degradation, effects of pollutants, efficiency, and outgassing. Test procedures and results are summarized in tables, graphs, and text.

B80-10195
OPERATIONAL TESTS OF A SOLAR-ENERGY SYSTEM IN GEORGIA
Innovator not given (Federal Systems Div. of IBM Corp.) Sep. 1980
M-FS-25420 **Vol. 5, No. 2, p. 174**
Seventy three page report describes one year performance of commercial solar-energy hot-water system. Silicone oil is heat-exchange fluid in tested system, designed to meet needs of family of four. Roll-bend heat exchanger is wrapped around hot-water storage tank. Oil circulates through exchanger and flat-plat solar collectors. Auxiliary energy, to maintain temperature in storage tank, is supplied by 4,500-watt resistance-heating element.

B80-10196
OPERATIONAL TESTS OF A SOLAR ENERGY SYSTEM FLORIDA SITE
Innovator not given (Federal Systems Division of IBM Corp.) Sep. 1980

M-FS-25423 **Vol. 5, No. 2, p. 174**
System has been evaluated for performance at test site in Loxahatchee, Florida. Results of tests are available in 76 page report. Projected annual electrical energy savings are above 10 million Btu.

B80-10197
A SOLAR-ENERGY SYSTEM IN PENNSYLVANIA
Innovator not given (Energy Resources Center of Honeywell, Inc.) Sep. 1980
M-FS-25427 **Vol. 5, No. 2, p. 174**
Report describes development of solar-heating system for single-family residence at site in Pennsylvania. 143 page document, containing detailed drawings, performance specifications, cost tradeoff studies, and other material, can assist those planning similar systems in areas of similar climate.

B80-10198
INSTALLATION GUIDELINES FOR THE PENNSYLVANIA SYSTEM
Innovator not given (Energy Resources Center of Honeywell, Inc.) Sep. 1980
M-FS-25424 **Vol. 5, No. 2, p. 175**
Installation of solar-energy system is documented in report. Included are procedures for filling and testing entire system, along with installation guidelines for each major subsystem.

B80-10199
A SOLAR-ENERGY SYSTEM IN MINNESOTA
Innovator not given (Energy Resources Center of Honeywell, Inc.) Sep. 1980
M-FS-25428 **Vol. 5, No. 2, p. 175**
Report discusses system for Minnesota residence. Final design was arrived at that will meet 45 percent of total average heating load and will supply 40 gallons of potable water at 140 F. Document contains detailed drawings, specifications, and cost tradeoff studies. Also included are outline of proposed installation, operation and maintenance manual, and analysis of hazards.

B80-10200
SOLAR-ENERGY SYSTEM EVALUATION-PENNSYLVANIA SITE
Innovator not given (Federal Systems Division of IBM Corp.) Sep. 1980 See also B79-10336
M-FS-25434 **Vol. 5, No. 2, p. 175**
Solar-heating and hot-water system installed in single-family residence test program. Results of tests are available in 82 page report.

B80-10201
A HOT-WATER SYSTEM TESTED ONSITE--TOGUS, MAINE
Innovator not given (Federal Systems Division of IBM Corp.) Sep. 1980 See also B78-10334
M-FS-25435 **Vol. 5, No. 2, p. 175**
Performance close to design specifications was verified over one year study in solar hot-water system. Study looked at long-term operation of system installed in residential building in Togus, Maine.

B80-10202
A RELIABLE SOLAR-HEATING SYSTEM--HUNTSVILLE, ALABAMA
Innovator not given (City of Huntsville) Sep. 1980
M-FS-25431 **Vol. 5, No. 2, p. 176**
Final report on solar-heating demonstration project in Huntsville, Alabama, is rich in technical data, planning considerations, test and maintenance data, and other information. It can be useful reference for those planning similar systems.

B80-10203
SOLAR-HEATING AND COOLING DEMONSTRATION PROJECT
Innovator not given (Florida Solar Energy Center of the Univ. of Florida) Sep. 1980
M-FS-25443 **Vol. 5, No. 2, p. 176**
Florida Solar Energy Center has retrofitted office building, approximately 5,000 square feet of area, with solar heating and air-conditioning. Information on operation, installation, controls, and hardware for system is contained in 164 page report. Document includes manufacturer's product literature and detailed drawings.

B80-10318
MULTIPLEXED LOGIC CONTROLS SOLAR-HEATING SYSTEM
J. R. CURRIE
Jan. 1981 See also B78-10182
M-FS-25287 **Vol. 5, No. 3, P. 297**
Four inexpensive thermocouples monitor temperatures at key points. On command from logic circuitry, dampers open and close to direct airflow, and fan and auxiliary heater shut on or off. Controlling complex arranges heating system in any one of four operating configurations.

B80-10319
FOUR-CELL SOLAR TRACKER
C. M. BERDAHL (Caltech)
Jan. 1981
NPO-14811 **Vol. 5, No. 3, p. 298**
Forty cm Sun tracker, consisting of optical telescope and four solar cells, stays pointed at Sun throughout day for maximum energy collection. Each solar cell generates voltage proportional to part of solar image it receives; voltages drive servomotors that keep image centered. Mirrored portion of cylinder extends acquisition angle of device by reflecting Sun image back onto solar cells.

B80-10320
OFFSET PARABOLOIDAL SOLAR CONCENTRATOR
E. Y. CHOW (Caltech)
Jan. 1981
NPO-14846 **Vol. 5, No. 3, p. 299**
Section of conventional paraboloid, offset from its major axis, is used as reflector in solar concentrator. Design increases solar gathering efficiency by 3 to 4 percent by eliminating shadowing and blocking of solar rays. In addition, reflector can be folded toward receiver, reducing wind-loading and making maintenance easier.

B80-10321
MINIATURE PERSONAL UV SOLAR DOSIMETER
R. R. ADAMS, I. O. MACCONOCHIE, and B. D. POOLE, JR.
Jan. 1981
LANGLEY-12469 **Vol. 5, No. 3, p. 300**
Small light-powered meter measures accumulated radiation in ultraviolet or other selected regions. Practical advantages are device's low cost, small size, accuracy, and adaptability to specific wave-band measurements. Medical applications include detection of skin cancer, vitamin D production, and jaundice. Dosimeter also measures sunlight for solar energy designs, agriculture and meteorology, and monitors stability of materials and environmental and occupational lighting.

B80-10322
ECONOMICAL ULTRAVIOLET RADIOMETER
C. H. SEAMAN (Caltech) and R. S. ESTEY (Kirk-Mayer, Inc.)
Jan. 1981
NPO-14843 **Vol. 5, No. 3, p. 301**
Inexpensive, cosine-corrected radiometer measures ultraviolet radiation. In field use, instrument tests materials for effects of ultraviolet exposure and studies solar-cell degradation. It consists of cup-shaped diaphragm and diffusing dome for corrected response, two filters that select wavelength range, and silicon solar cell. Filters control response within passband of 300 to 400 nm.

B80-10323
PREDICTING AND MONITORING DUSTSTORMS
P. M. WOICESHYN (Caltech)
Jan. 1981
NPO-14277 **Vol. 5, No. 3, p. 302**
Information on duststorms is processed by terminal receiving

signals from two geosynchronous satellites. Data are correlated with that of other agencies to produce color maps depicting storm area. Series of maps reveals storm direction, warning regions up to 24 hours before they are struck.

B80-10324
NOISE SUPPRESSION IN FORWARD-SCATTERING OPTICAL INSTRUMENTS
J. M. FRANKE and L. R. GARTRELL
Jan. 1981
LANGLEY-12730 **Vol. 5, No. 3, p. 303**
Apertures and stops located at conjugate points in receiver optics reduce noise caused by scattered light. They are placed as real, inverse images of each other, so only light from sample volume reaches detector. Noise suppression technique increases signal-to-noise ratio on order of 15 dB.

B80-10325
ENERGY-REDUCTION CONCEPT FOR INCANDESCENT LAMPS
K. H. VORHABEN (Lockheed Electronics Co.)
Jan. 1981
MSC-18757 **Vol. 5, No. 3, p. 304**
Reusable infrared reflector maintains filament temperature and reduces power requirements. Fixed installed over light bulb directs energy formerly lost back to lamp filament. This energy aids electric current in heating filament, allowing lower-wattage bulb to produce same amount of light as higher-wattage bulb in ordinary fixture.

B80-10326
ACOUSTICALLY-TUNED OPTICAL SPECTROMETER
E. SKLAR (American Science and Engineering, Inc.)
Jan. 1981
HQN-10924 **Vol. 5, No. 3, p. 304**
Lens arrangement corrects for aberrations and gives resolution of 0.7 seconds of arc. In spectrometer, light from telescope is relayed by doublet lens to acoustically tuned optical filter. Selected wavelengths are relayed by triplet lens to charge coupled device camera. Intervening cylindrical lens, tilted at 12 degree angle, corrects for astigmatism and coma introduced by two element birefringent crystal in filter.

B80-10327
COMBINED PHOTOVOLTAIC AND THERMAL-STORAGE MODULE
J. W. STULTZ (Caltech)
Jan. 1981
NPO-14591 **Vol. 5, No. 3, p. 305**
Module uses phase change heat absorbing wax to reduce peak temperatures, increasing electrical efficiency. Wax makes module more cost effective than conventional thermomodules by also storing thermal energy for air and water heating.

B80-10328
TRACKING FALLING OBJECTS
R. E. FRAZER (Caltech)
Jan. 1981
NPO-14813 **Vol. 5, No. 3, p. 306**
Moving lens follows movement of object accelerated by gravity. Lenses and mirrors maintain constant magnification regardless of distance between moving optical carriage mechanism and fixed telescope. Device tracks objects up to 2 cm in diameter over vertical distance of 2 m.

B80-10329
DIPLEXER FOR LASER-BEAM HETERODYNE RECEIVER
G. KOEPF (Phoenix Corp.)
Jan. 1981
GSFC-12589 **Vol. 5, No. 3, p. 307**
Four prism interferometer superposes local oscillator beam on signal beam. Position of movable prism directs incident energy in both beams out one output port. Output port is spatially separated from input ports, and there is no limitation on size of frequency difference between laser beams.

B80-10330
POWERFUL COPPER CHLORIDE LASER
T. J. PIVIROTTO (Caltech)
Jan. 1981
NPO-14782 **Vol. 5, No. 3, p. 308**
Two design innovations give up to thirtyfold increase in power in 300 W laser amplifier. Heat is removed by flowing lasing gas through system, allowing larger lasing volumes. Fast, uniform excitation discharges are obtained with transverse, rather than longitudinal, electrodes.

B80-10331
HEAT FOR FILM PROCESSING FROM SOLAR ENERGY
Innovator not given (Interactive Resources, Inc.) Jan. 1981 See also DOE/NASA-CR-161414 (N80-22781)
M-FS-25444 **Vol. 5, No. 3, p. 309**
Report describes solar water heating system for laboratory in Mill Valley, California. System furnishes 59 percent of hot water requirements for photographic film processing. Text of report discusses system problems and modifications, analyzes performance and economics, and supplies drawings and operation/maintenance manual.

B80-10332
SOLAR HEATER/COOLER FOR MASS MARKET
Innovator not given (Space Div. of GE) Jan. 1981 See also DOE/NASA-CR-161422 (N80-24746)
M-FS-25452 **Vol. 5, No. 3, p. 309**
Report describes project to design, build, and test simple and affordable solar systems. Four combinations of heating, cooling, and domestic hot water supply systems were developed and installed. Test sites, plan for systems and components, and performance are discussed; text is complimented by detailed drawings and test data.

B80-10333
DATA-ACQUISITION AND CONTROL SYSTEM FOR SEVERE ENVIRONMENTS
Innovator not given (Wyle Labs., Inc.) Jan. 1981 See also DOE/NASA-CR-161449 (N80-25783)
M-FS-25471 **Vol. 5, No. 3, p. 310**
Report evaluates control system by measuring accuracy and performance of system subcomponents, including interface wiring unit, power controller, and tape recorder. Test parameters establish variety of severe operation environments. Text features test program descriptions, sample readouts, and results. Summary of custom solar system simulator is included.

B80-10334
SOLAR HEATER/COOLER FOR MASS MARKET
Innovator not given (Lutz-Sotire Partnership) Jan. 1981 See also DOE/NASA/CR-161436 (N80-27800)
M-FS-25468 **Vol. 5, No. 3, p. 310**
Electrical energy consumption is reduced by half for 2 1/2 story office building. 138 liquid flat plate solar collectors are mounted on building roof, which faces nearly due south. Final project report includes detailed drawings and photographs, operation and maintenance manual, acceptance test plan, and related information.

B80-10335
SOLAR-HEATED AND COOLED OFFICE BUILDING--DALTON, GEORGIA
Innovator not given (N. GA. Area Planning and Development Commission) Jan. 1981 See also DOE/NASA-CR-161273 (N80-11555)
M-FS-25451 **Vol. 5, No. 3, p. 310**
Modern energy efficient building is heated and cooled by five rows of flat plate solar collectors; its domestic hot water needs are also met. Final report includes detailed drawings and photographs, manufacturer's literature, performance specifications, acceptance test data, and performance verification statements. Operation and maintenance manual is also attached.

B80-10336
SOLAR-HEATING AND HOT WATER SYSTEM--ST. LOUIS, MISSOURI

Innovator not given (William Tao and Assoc.) Jan. 1981 See also DOE/NASA-CR-161420 (N80-24744)

M-FS-25453 **Vol. 5, No. 3, p. 311**

Sunlight supplies about half heat energy needs of small office. System includes six tilt-adjustable commercial collectors and 1,000 gallon energy storage tank. Report contains description of system and components, drawings and photographs, manufacturer's data, and related material.

B80-10337

SOLAR HEATING FOR AN ELECTRONICS MANUFACTURING PLANT--BLUE EARTH, MINNESOTA

Innovator not given (Telex Comm., Inc.) Jan. 1981 See alos DOE/NASA-CR-161437 (N80-25786)

M-FS-25469 **Vol. 5, No. 3, p. 311**

Partial space heating for 97,000 square foot plant is supplied by 360 flat plate solar collectors; energy is sorted as heat in indoor 20,000 gallon water tank. System includes all necessary control electronics for year round operation. During December 1978, solar energy supplied 24.4 percent of building's space heating load.

B80-10338

COSTS AND DESCRIPTION OF A SOLAR-ENERGY SYSTEM--AUSTIN, TEXAS

Innovator not given (Radian Corp.) Jan. 1981 See also DOE/NASA-CR-161442 (N80-25784)

M-FS-25472 **Vol. 5, No. 3, p. 312**

Heating and cooling system uses Fresnel lens concentrating collectors. Major system components are 36 collectors, 1,500 gallon thermal storage tank, absorption cooler, cooling tower, heating coil, pumps, heat exchanger, and backup heating and air conditioning. Final report includes detailed breakdown of component and installation costs for seven project subsystems.

B80-10339

SOLAR ENERGY IN A HISTORICAL CITY--ABBREVILLE, SOUTH CAROLINA

Innovator not given(Gilliland-Bell Assoc., Inc.) Jan. 1981 See also DOE/NASA-CR-161443(N80-25788)

M-FS-25479 **Vol. 5, No. 3, p. 312**

Direct air solar heating does not alter building appearances, winning approval of state and local historical societies. Final report on system contains performance data, drawings, photographs, and other information. Installation manual is included as appendix.

B80-10340

MUNICIPAL RECREATION CENTER IS HEATED AND COOLED BY SOLAR ENERGY

innovator not given(Travis-Braun and Assoc., Inc.) Jan. 1981 See also DOE/NASA-CR-161444(N80-26766)

M-FS-25478 **Vol. 5, No. 3, p. 312**

Major fraction of energy requirements for community building is ksupplied by Sun. The 238 flat plate solar collectors are roof mounted on single story structure enclosing gymnasium, locker area, and health care clinic; heat exchanger transfers collected energy to 6,000 gallon storage tank. Final report chronicles project from inception to completion, documenting performance, costs, operating modes, and data acquisition system. Appendix contains manufacturers' product literature and engineering drawings.

B80-10341

SOLAR ENERGY MEETS 50 PECENT OF MOTEL HOT WATER NEEDS--KEY WEST, FLORIDA

Innovator not given(Quality Inn of Key West) Jan. 1981 See also DOE/NASA-CR-161434(N80-23774)

M-FS-25454 **Vol. 5, No. 3, p. 313**

Final report describes domestic water preheat installed in 148 room motel. Equipment meets 50 percent of needs when motel is 100 percent occupied; equivalently, it supplies 100 percent of hot water when occupancy is 50 percent. System consists of 1,400 square feet of flat plate liquid solar collectors, storage tanks, pump, controller, and hardware.

B80-10342

SOLAR HEATED OFFICE COMPLEX--GREENWOOD, SOUTH CAROLINA

Innovator not given(W. E. Gilbert & Assoc., Inc.) Jan. 1981 See also DOE/NASA-CR-161435(N80-23776)

M-FS-25458 **Vol. 5, No. 3, p. 313**

Report contains thorough docuumentation of project meeting 85 percent of building heat requirements. System uses roof mounted recirculating water solar panels and underground hot water energy storage. Aluminum film reflectors increase total solar flux captured by panels.

B80-10343

RESIDENTIAL SYSTEM TESTED IN AN OFFICE--HUNTSVILLE, ALABAMA

Innovator not given(IBM Federal Systems Div.) Jan. 1981 See also DOE/NASA-CR-161464(N80-25790)

M-FS-25481 **Vol. 5, No. 3, p. 314**

System does not meet its design specifications if not matched with intended application. Key differences between office and residential application were (1) space heating demand at office was greater than design value because thermostat was not held at 70 degrees F as specified, and (2) much energy collected and stored went unused because office used relatively little hot water. Report discusses observations and contains design, performance, and test information.

B80-10344

SOLAR HEATED TWO LEVEL RESIDENCE--AKRON, OHIO

Innovator not given(IBM Federal Systems Div.) Jan. 1981 See also DOE/NASA-CR-161465(N80-25791)

M-FS-25480 **Vol. 5, No. 3, p. 314**

Report describes 1 year evaluation of solar heating and hot water system which satisfied 24 percent of energy requirements. System uses flat plate solar collectors with air as heat transport medium. Rock storage bin stores collected energy; air to liquid heat pump supplies backup heat.

B80-10345

SOLAR ENERGY WORKSHOP--TUCSON, ARIZONA

Innovator not given(IBM Federal Systems Div.) Jan. 1981 See also DOE/NASA-CR-161450(N80-25787)

M-FS-25473 **Vol. 5, No. 3, p. 314**

Showplace for solar energy utilization includes complex solar heating and cooling system which supplies 95 percent of space heat requirements. Project utilized superior construction techniques and quality materials, and full time maintenance staff was assigned to keep systems operating.

B80-10346

RESIDENTIAL SOLAR HOT WATER SYSTEM--TEMPE, ARIZONA

Innovator not given(IBM Federal Systems Div.) Jan. 1981 See also DOE/NASA-CR-161466(N80-26778)

M-FS-25490 **Vol. 5, No. 3, p. 315**

Domestic hot water for single story home is heated by two 4 by 8 foot solar collectors. Solar energy saved 5.54 million Btu in six month period; savings with increased water consumption would be significantly higher.

B80-10347

RESIDENTIAL SOLAR HEATING INSTALLATION--STILLWATER, MINNESOTA

Innovator not given(Energy Resources Ctr. of Honeywell, Inc.) Jan. 1981 See also B80-10199; DOE/NASA-CR-161480(N80-28861)

M-FS-25504 **Vol. 5, No. 3, p. 315**

Report presents installer guidelines for network subsystems, including filling and testing. Information on operating procedures, controls, caution requirements, and routine scheduled maintenance is included as written procedures, schematics, detailed drawings, and manufacturer's component data.

B80-10348

THREE STORY RESIDENCE WITH SOLAR HEAT--MANCHESTER, NEW HAMPSHIRE

Innovator not given(IBM Federal Systems Div.) Jan. 1981 See

also DOE/NASA-CR-161471(N80-27802)
M-FS-25499 **Vol. 5, No. 3, p. 315**
When heat lost through ducts is counted for accurate performance assessment, solar energy supplied 56 percent of building's space heating load. Average outdoor temperature was 53 degrees F; average indoor temperature was 69 degrees F. System operating modes included heating from solar collectors, storing heat, heating from storage, auxiliary heating with oil fired furnace, summer venting, and hot water preheating.

B80-10349
A HIGH SCHOOL IS SUPPLIED WITH SOLAR ENERGY--DALLAS, TEXAS
Innovator not given(Dallas Independent School District) Jan. 1981 See also DOE/NASA-CR-161482(N80-29847)
M-FS-25514 **Vol. 5, No. 3, p. 316**
System preheats 100 percent of domestic hot water and supplies almost half of heating requirements for three story, concrete frame, brick building with basement. Final report includes details of installation, operation and maintenance, contract negotiation, and acceptance test plan.

B80-10452
MULTIBEAM COLLIMATOR USES PRISM STACK
P. O. MINOTT
Apr. 1981
GSFC-12608 **Vol. 5, No. 4, p. 427**
Optical instrument creates many divergent light beams for surveying and machine element alignment applications. Angles and refractive indices of stack of prisms are selected to divert incoming laser beam by small increments, different for each prism. Angles of emerging beams thus differ by small, precisely-controlled amounts. Instrument is nearly immune to vibration, changes in gravitational force, temperature variations, and mechanical distortion.

B80-10453
PULSE-SHAPING CIRCUIT FOR LASER EXCITATION
J. B. LAUDENSLAGER (Caltech) and T. J. PACALA (Caltech)
Apr. 1981
NPO-14556 **Vol. 5, No. 4, p. 428**
Narrower, impedence-matched pulses initiate stabler electric discharges for gas lasers. Discharges are more efficient, more compact, capable of high repetition rate, and less expensive than conventional electron-beam apparatus, but gas tends to break down and form localized arcs. Pulse-shaping circuit compresses width of high-voltage pulses from relatively-slow rise-time voltage generator and gradually grades circuit impedance from inherent high impedance of generator to low impedence of gas.

B80-10454
FIELD LIMITER FOR SOLAR RADIOMETERS
C. M. BERDAHL (Caltech)
Apr. 1981
NPO-14781 **Vol. 5, No. 4, p. 429**
Lenses project solar image onto aperature to exclude circumsolar radiation, more precisely measuring energy captured by receiver aperatures of highly-concentrating solar thermal-energy converters. First version uses achromatic objective lens to form image of Sun at aperature ahead of radiometer cavity. Smaller second version with shorter focal length forms image magnified by another lens and thrown onto aperature. Both Versions require calibration against standard radiometer.

B80-10455
GAS-LASER POWER MONITOR
C. E. RUSS, JR.
Apr. 1981
LANGLEY-12682 **Vol. 5, No. 4, p. 430**
Device attaches simply to front of laser housing for continuous monitoring of power output. Monitor is calibrated to read either total output or power generated in test volume. It is fabricated from four black-anodized aluminum parts; crown glass positioned at Brewster angle reflects 0.33 percent of beam onto photodiode calibrated for electrical output proportional to laser power. Unlike conventional calorimeter, monitor does not interrupt laser beams, and fast-response diode allows instantaneous tracking of power fluctuations.

B80-10456
FIBER OPTICS TRANSMIT CLOCK SIGNAL MORE RELIABLY
G. F. LUTES, JR. (Caltech)
Apr. 1981
NPO-14749 **Vol. 5, No. 4, p. 430**
Optical automatic gain control smooths maser clock amplitude fluctuations without phase shift. Uncomplicated optical system is more reliable than electrical transmission circuits which require phase-locked loops to compensate for shift. Maser feeds reference signal to linear fiber-optic analog transmitter which emits modulated laser beam directed to splitter. Splitter consists of dichroic mirrors and associated lenses for distributing beam to output ports. Cables attached there guide signals to receiving station.

B80-10457
REDUCED VISCOSITY INTERPRETED FOR FLUID/GAS MIXTURES
D. H. LEWIS (Caltech)
Apr. 1981
NPO-14976 **Vol. 5, No. 4, p. 431**
Analysis predicts decrease in fluid viscosity by comparing pressure profile of fluid/gas mixture with that of power-law fluid. Fluid is taken to be viscous, non-Newtonian, and incompressible; the gas to be ideal; the flow to be inertia-free, isothermal, and one dimensional. Analysis assists in design of flow systems for petroleum, coal, polymers, and other materials.

B80-10458
TUNABLE PULSED CARBON DIOXIDE LASER
G. J. MEGIE (Caltech) and R. T. MENZIES (Caltech)
Apr. 1981
NPO-14984 **Vol. 5, No. 4, p. 432**
Transverse electrically-excited-atmosphere (TEA) laser is continuously tunable over several hundred megahertz about centers of spectral lines of carbon dioxide. It is operated in single longitudinal mode (SLM) by injection of beam from continuous-wave, tunable-waveguide carbon dioxide laser, which serves as master frequency-control oscillator. Device measures absorption line of ozone; with adjustments, it is applicable to monitoring of atmospheric trace species.

B80-10459
SHORT-RANGE SELF-PULSED OPTICAL RADAR
C. M. BERDAHL (Catech)
Apr. 1981
NPO-14901 **Vol. 5, No. 4, p. 433**
Laser for radar device is retriggered when previous laser pulse is reflected from target. Target range R is computed from number of pulses triggered per time interval. Radar accurately measures distances up to 500 meters; it is useful for determining surface shape of relfectors in large, high-gain, highly directional antennas and for other short-range surveying.

B80-10460
SOLAR-SITE TEST MODULE
R. R. KISSEL and D. R. SCOTT
Apr. 1981 See also DOE/NASA-TM-78291(N80-30899)
M-FS-25543 **Vol. 5, No. 4, p. 433**
Report describes small test set which interrogates solar-energy data acquisition systems. Lightweight, portable set includes microcomputer with keyboard, alphanumeric display, printer, cassette recorder/player for storing programs and data, and cable for connection to Site Data Acquisition System (SDAS). Unit is operated by BASIC program and Assembly language. Report is specific to DOE/NASA application yet contains general information to assist in designing similar units.

B80-10461
EVALUATION OF AN EVACUATED-TUBE LIQUID SOLAR COLLECTOR
Innovator not given(Solar Energy Systems Div. of Wyle

Labs) Apr. 1981 See also DOE/NASA-CR-161421(N80-24745); B80-10050
M-FS-25450 **Vol. 5, No. 4, p. 434**
Indoor and outdoor thermal performances of collectors are compared in report. Tests conducted on indoor solar simulator with data from both diffuse and specular reflectors are presented graphically and in tables. Comparisons with previous data for prototype show effects of improved mainfold.

B80-10462
SOLAR WATER HEATER DESIGN PACKAGE
Innovator not given(Elcam, Inc.) Apr. 1981 See also DOE/NASA-CR-150605(N80-27518)
M-FS-25521 **Vol. 5, No. 4, p. 434**
Package describes commercial domestic-hot-water heater with roof or rack mounted solar collectors. System is adjustable to pre-existing gas or electric hot-water house units. Design package includes drawings, description of automatic control logic, evaluation measurements, possible design variations, list of materials and installation tools, and trouble-shooting guide and manual.

B80-10463
FIVE-CITY ECONOMICS OF A SOLAR HOT-WATER-SYSTEM
Innovator not given(Federal Systems Div. of IBM Corp.) Apr. 1981 See also DOE/NASA-CR-161510(N80-29854)
M-FS-25532 **Vol. 5, No. 4, p. 434**
Report projects energy savings and system costs for five sites using analysis of actual solar energy installation performance in Togus, Maine. Maine system supplies 75 percent of hot water needed for single-family residence; economic payback period is 19 years. Benefits for all sites depend on maintenance or decrease of initial investment required and continuing increase in cost of conventional energy. Report includes analysis weighing potential changes in variables used to evaluate system profitability.

B80-10464
ECONOMIC EVALUATION OF A SOLAR HOT-WATER-SYSTEM
Innovator not given(Federal Systems Div. of IBM Corp.) Apr. 1981 See also DOE/NASA-CR-161492(N80-31872)
M-FS-25529 **Vol. 5, No. 4, p. 435**
Analysis shows economic benefits at six representative sites using actual data from Tempe, Arizona and San Diego, California installations. Model is two-tank cascade water heater with flat-plate collector array for single-family residences. Performances are forecast for Albuquerque, New Mexico; Fort Worth, Texas; Madison, Wisconsin; and Washington, D.C. Costs are compared to net energy savings using variables for each site's environmental conditions, loads, fuel costs, and other economic factors; uncertainty analysis is included.

B80-10465
RESIDENTIAL SOLAR-HEATING SYSTEM USES PYRAMIDAL OPTICS
Innovator not given(Wormser Scientific Corp.) Apr. 1981 See also DOE/NASA-CR-161203(N80-33864)
M-FS-25567 **Vol. 5, No. 4, p. 435**
Report describes reflective panels which optimize annual solar energy collection in attic installation. Subunits include collection, storage, distribution, and 4-mode control systems. Pyramid optical system heats single-family and multi-family dwellings.

B80-10466
SOLAR-HEATED BANK-MARKS MISSISSIPPI
Innovator not given(First National Bank of Clarksdale) Apr. 1981 See also DOE/NASA-CR-161549(N80-33858)
M-FS-25558 **Vol. 5, No. 4, P. 436**
Report describes air solar-energy collectors which supply 60 percent of space heating load for full-service bank. Contemporary structure supports 468 square feet of flat-plate arrays, and features onsite temperature and power measurement readouts. Air-flow collectors minimize problems experienced with conventional liquid solar equipment and eliminate need for heat exchanger for space heating.

B80-10467
SOLAR WATER-HEATING PERFORMANCE EVALUATION-SAN DIEGO, CALIFORNIA
Innovator not given(Federal Systems Div. of IBM Corp.) Apr. 1981 See also DOE/NASA-CR-161481(N80-27806)
M-FS-25502 **Vol. 5, No. 4, p. 436**
Report describes energy saved by replacing domestic, conventional natural gas heater with solar-energy subsystem in single-family residence near San Diego, California. Energy savings for 6 month test period averaged 1.089 million Btu. Collector array covered 65 square feet and supplied hot water to both 66-gallon solar storage tank and 40-gallon tank for domestic use. Natural gas supplied house's auxiliary energy.

B80-10468
SOLAR-HEATED AND COOLED SAVINGS AND LOAN BUILDING-1-LEAVENWORTH, KANASAS
Innovator not given(Mutual Savings & Loan Association of Leavenworth, Kanas) Apr. 1981 See also DOE/NASA-CR-161484(N80-29848)
M-FS-25520 **Vol. 5, No. 4, p. 436**
Report describes heating and cooling system which furnishes 90 percent of annual heating load, 70 percent of cooling load, and all hot water for two-story building. Roof-mounted flat-plate collectors allow three distinct flow rates and are oriented south for optimum energy collection. Building contains fully automated temperature controls is divided into five temperature-load zones, each with independent heat pump.

B80-10469
SOLAR-ENERGY LANDMARK BUILDING--COLUMBIA, MISSOURI
Innovator not given(Building and Grounds Department of Stephens College) Apr. 1981 See also DOE/NASA-CR-161485(N80-29849)
M-FS-25524 **Vol. 5, No. 4, p. 437**
Report includes design, cost, installation, maintenance, and performance details for attractive solar installation which supplies space heating for four-story Visitors Center. 176 hydronic flat-plate collectors, water-to-water heat exchanger, and 5,000-gallon storage tank comprise system which provides 71 percent of building's heat. Natural-gas-fired boiler supplies auxiliary hot water to heating system when necessary.

B80-10470
SOLAR HEATING FOR AN OBSERVATORY--LINCOLN, NEBRASKA
Innovator not given(Federal Systems Div. of IBM Corp.) Apr. 1981 See also DOE/NASA-CR-161495(N80-29851)
M-FS-25525 **Vol. 5, No. 4, p. 437**
Report describes solar-energy system for 50 seat observatory that provides 60 percent of space heating needs. System includes 9 flat-plate collectors, rock storage bin, blowers, controls, ducting, and auxiliary natural-gas furnace; it has five operation modes. Net energy savings were 11.31 million Btu for 12 months, or equivalent of 1.9 barrels of oil. Report appendixes list performance factor definitions, performance equations, and average area weather conditions.

B80-10471
TWO-STORY RESIDENCE WITH SOLAR HEATING--NEWMAN, GEORGIA
Innovator not given(Federal Systems Div. of IBM Corp.) Apr. 1981 See also DOE/NASA-CR-161494(N80-29853)
M-FS-25526 **Vol. 5, No. 4, p. 438**
Report evaluates performance of warm-air collector system for 11 month period and provides operation and maintenance information. System consists of 14 warm air collectors, rock-storage bin, air handler, heat exchangers, hot-water preheat tank, associated controls, plumbing, and air ducting. Average building temperature was maintained at 72 F (22 C); solar equipment provided 47 percent of space-heating requirement.

B80-10472
SOLAR-ENERGY HEATS A TRANSPORTATION TEST CENTER--PUEBLO, COLORADO

Innovator not given(Federal Systems Div. of IBM Corp.) Apr. 1981 See also DOE/NASA-CR-161493(N80-29850)
M-FS-25527 **Vol. 5, No. 4, p. 438**
Petroleum-base, thermal energy transport fluid circulating through 583 square feet of flat-plate solar collectors accumulates majority of energy for space heating and domestic hot-water of large Test Center. Report describes operation, maintenance, and performance of system which is suitable for warehouses and similar buildings. For test period from February 1979 to January 1980, solar-heating fraction was 31 percent, solar hot-water fraction 79 percent.

B80-10473
SINGLE-FAMILY-RESIDENCE SOLAR HEATING--CARLSBAD, NEW MEXICO
Innovator not given(Federal Systems Div. of IBM Corp.) Apr. 1981 See also DOE/NASA-CR-161508(N80-29856)
M-FS-25528 **Vol. 5, No. 4, p. 438**
Solar-heating and hot-water system includes 408 square feet of flat-plate air collectors, rock storage bin, energy transport system, air-to-water heat exchanger, controls, and hot-water preheat tank. Hot-air oil furnace supplies auxiliary space heating, and electricity powers air-handler blower and hot water preheat pump. For 12 month period, system provided 43 percent of space-heating and 53 percent of hot-water energy; net energy savings were 23.072 million Btu.

B80-10474
MULTIMODE SOLAR-HEATING SYSTEM--COLUMBIA, SOUTH CAROLINA
Innovator not given(Federal Systems Div. of IBM Corp.) Apr. 1981 See also DOE/NASA-CR-161546(N80-31880)
M-FS-25552 **Vol. 5, No. 4, p. 439**
Report describes failure of six-mode pyramidal-optics system to reduce winter energy savings. Over 12 month period, control problems, energy dissipation, and high operating-energy requirements undermined system efficiency. Energy savings were maximal when system in direct space-heating or hot-water preheating mode. In least efficient mode, heat pumps alternatively mingled storage or collector energy, and space heating was provided by electric heat strip.

B80-10475
SOLAR-HEATED SWIMMING SCHOOL--WILMINGTON, DELAWARE
Innovator not given(Cooperson Brack Association) Apr. 1981 See also DOE/NASA-CR-161538(N80-31878)
M-FS-25548 **Vol. 5, No. 4, p. 439**
Report describes operation, installation, and performance of solar-energy system which provides alternative to natural gas pool heating. System is comprised of 2,500 square feet of liquid flat-plate collectors connected to 3,600 galloon; gallongalloon storage tank, with microcomputer-based controls. Extension of building incorporates vertical-wall, passive collection system which provides quarter of heated fresh air for office.

B80-10476
WINTER PERFORMANCE OF A DOMESTIC SOLAR-HEATING SYSTEM--DUFFIELD, VIRGINIA
Innovator not given(Federal Systems Div. of IBM Corp.) Apr. 1981 See also DOE/NASA-CR-161507(N80-30892)
M-FS-25540 **Vol. 5, No. 4, p. 439**
Sunlight supplies 39 percent of heat load, saving 9 barrels of fuel oil in one heating season. Report describes system installation in two-story, single-family residence. Energy is collected with roof-mounted air flat-plate collectors, stored in rock bin, and transferred to water preheat tank whenever system is storing energy; heat pump supplies heat to house.

B80-10477
ONE-YEAR ASSESSMENT OF A SOLAR SPACE/WATER HEATER--CLINTON, MISSISSIPPI
Innovator not given(Federal Systems Div. of IBM Corp.) Apr. 1981 See also DOE/NASA-CR-161509(N80-30893)
M-FS-25539 **Vol. 5, No. 4, p. 440**
Unit called 'System 4' integrated into space-heating and hot-water systems of dormitory satisfied 32 percent of building heat load. System 4 includes flat-plate air collectors, circulation blowers, rock storage bed with heat exchanger, two hot water tanks, and auxiliary heaters. Report describes performance of system and subsystems, operating-energy requirements and savings, and performance parameters.

B80-10478
FIRE-STATION SOLAR-ENERGY SYSTEM--KANSAS CITY, MISSOURI
Innovator not given(City of Kansas City, Missouri) Apr. 1981 See also DOE/NASA-CR-161513(N80-30895)
M-FS-25538 **Vol. 5, No. 4, p. 440**
Screen-walled, flat-plate air collectors are part of award-winning architectural design; concrete-box storage subsystem, domestic hot-water preheat tank, blowers, pumps, heat exchangers, ducting, controls, and plumbing complete solar system. Design provides half of space heating and 75 percent of heat for domestic hot-water for fire station. Report includes historical narrative of project along with detailed drawings, charts, and product literature.

B80-10479
SOLAR-HEATED RANGER STATION--GLENDO, WYOMING
Innovator not given(Federal Systems Div. of IBM Corp.) Apr. 1981 See also DOE/NASA-CR-161520(N80-30896)
M-FS-25537 **Vol. 5, No. 4, p. 440**
Report evaluates solar-energy system in residential ranger station. Installation provided 22 percent of space-heating and 58 percent of hot-water energy requirements. Annual net energy savings were 30 million Btu. Report describes system and its subsystems: collector array, storage, hot-water, and space-heating. Average weather conditions of test site, performance values, and energy savings are listed.

B80-10480
ECONOMIC EVALUATION OF A SOLAR HOT-WATER SYSTEM--PALM BEACH COUNTY, FLORIDA
Innovator not given(Federal Systems Div. of IBM Corp.) Apr. 1981 See also DOE/NASA-CR-161512(N80-30894)
M-FS-25536 **Vol. 5, No. 4, p. 441**
Report projects solar-energy costs and savings for residential hot-water system over 20 year period. Evaluation uses technical and economic models with inputs based on working characteristics of installed system. Primary analysis permits calculation of economic viability for four other U.S. sites.

B80-10481
RESIDENTIAL SYSTEM--LANSING, MICHIGAN
Innovator not given(Federal Systems Div. of IBM Corp.) Apr. 1981 See also DOE/NASA-CR-161491(N80-29855)
M-FS-25530 **Vol. 5, No. 4, p. 411**
Air collectors are combined with water storage to supply 15 percent of space-heating and hot-water load to residence. Report discusses typical system operation, energy savings, and miantenance for 11 month period. Although unusual combination of water storage with air collecting medium creates loss of heat exchanging efficiency, net energy savings were 21 million Btu.

B80-10482
SOLAR SPACE-HEATING SYSTEM--YOSEMITE NATIONAL PARK, CALIFORNIA
Innovator not given(Federal Systems Div. of IBM Corp.) Apr. 1981 See Also DOE/NASA-CR-161539(N80-31883)
M-FS-25553 **Vol. 5, No. 4, p. 442**
A 12 months performance of Visitors Center installation suffered from low insolation, high energy dissipation, and equipment breakdown. System has 980 square feet of liquid flat-plate collectors, water energy storage, 4-mode control, heat exchangers, pumps, and plumbing. Design expected system to supply over 50 percent of annual heating demand, but only 109 million Btu were conserved.

B80-10483
MOTEL SOLAR-HOT-WATER SYSTEM--DALLAS, TEXAS

Innovator not given(Day's Inn of America, Inc.) Apr. 1981 See also DOE/NASA-CR-161570(N81-10521)
M-FS-25575 **Vol. 5, No. 4, p. 442**
Report describes system which meets 64 percent of hot water requirements of 120 room motel. Key system components include 1,000 square foot, roof-mounted collector array, 1,000 gallon storage tank, tube-in-shell heat exchanger, and three domestic hot-water tanks. Report contains calibration instructions for differential temperature controllers, shutdown procedures, and operation guidelines, performance analysis, and manufacturers' maintenance literature.

B80-10484
MOTEL SOLAR-HOT-WATER SYSTEM WITH NONPRESSURIZED STORAGE--JACKSONVILLE, FLORIDA
Innovator not given(Day's Inn of America, Inc.) Apr. 1981 See also DOE/NASA-CR-161560(N81-10523)
M-FS-25569 **Vol. 5, No. 4, p. 432**
Modular roof-mounted copper-plated arrays collect solar energy; heated water drains from them into 1,000 gallon nonpressurized storage tank which supplies energy to existing pressurized motel hot water lines. System provides 65 percent of hot water demand. Report described systems parts and operation, maintenance, and performance and provides warranty information.

B80-10485
CLOSED-CIRCULATION SYSTEM FOR MOTEL HOT WATER--SAVANNAH, GEORGIA
Innovator not given(Day's Inn of America, Inc.) Apr. 1981 See also DOE/NASA-CR-161561(N81-10522)
M-FS-25572 **Vol. 5, No. 4, p. 433**
Inexpensive guy wires support roof-mounted solar-energy collectors. Mounting system withstands 120 mph winds with no roof penetrations. Collectors circulate 50 percent ethylene glycol solution eliminating need for drain system for freeze protection. Heat exchanger transfers energy to domestic hot water which heats to 140 F.

B80-10486
SOLAR HEATING FOR A RESTAURANT--NORTH LITTLE ROCK, ARKANSAS
Innovator not given(Shoney's South, Inc.) Apr. 1981 See also DOE/NASA-CR-161557(N81-10520)
M-FS-25568 **Vol. 5, No. 4, p. 443**
Hot water consumption of large building affects solar-energy system design. Continual demand for hot water at restaurant makes storage less important than at other sites. Storage capacity of system installed in December 1979 equals estimated daily hot-water requirement. Report describes equipment specifications and modifications to existing building heating and hot water systems.

B80-10487
MOTEL SOLAR HOT-WATER INSTALLATION--ATLANTA, GEORGIA
Innovator not given(Day's Inn of America, Inc.) Apr. 1981 See also DOE/NASA-CR-161559(N81-10519)
M-FS-25564 **Vol. 5, No. 4, p. 443**
Analysis of hardness of local water, average insolation for site, and daily hot water requirements insures suitability of solar-energy system design. Report describes two units which are designed to supply 81 percent of motel's annual hot water demand based on hypothetical 85 percent occupancy. Report includes drawings, operating and maintenance instructions, and test results for 1 day of operation.

B80-10488
BUILDING WITH INTEGRAL SOLAR-HEAT STORAGE--STARKVILLE, MISSISSIPPI
Innovator not given(Security State Bank, Starkville, Mississippi) Apr. 1981 See also DOE/NASA-CR-161550(N81-10518)
M-FS-25559 **Vol. 5, No. 4, p. 444**
Column supporting roof also houses rock-storage bin of solar-energy system supplying more than half building space heating load. Conventional heaters supply hot water. Since bin is deeper and narrower than normal, individual pebble size was increased to keep airflow resistance at minimum.

04 MATERIALS

B80-10059
CONTAINERLESS MATERIALS PROCESSING IN THE LABORATORY
L. L. LACY, D. B. NISEN, T. J. RATHZ, and M. B. ROBINSON
Aug. 1980
M-FS-25242 **Vol. 5, No. 1, p. 45**
Drop tube makes possible preparation of exotic materials. The 100 foot tube is oriented precisely vertical to prevent free-falling drop from hitting tube walls. Inert-gas supply, evacuation pumps, viewing ports, and flexibility in choice of melt technique allow precise control and monitoring of solidification.

B80-10060
MEASURING COAL DEPOSITS BY RADAR
T. A. BARR
Aug. 1980
M-FS-23922 **Vol. 5, No. 1, p. 46**
Front-surface, local-oscillator radar directly compares frequency of signals reflected from front and back surfaces of coal deposits. Thickness is measured directly as frequency difference. Transmitter is frequency modulated, so thickness is computed directly from frequency difference. Because front and back reflections are detected in combination rather than separately, masking of comparatively weak back signal is less problem. Also system is not sensitive to extraneous reflections from targets between transmitting antenna and coal surface.

B80-10061
DETECTING A COAL/SHALE INTERFACE
P. H. BROUSSARD, J. L. BURCH, R. A. CAMPBELL, E. J. DROST, J. L. HUDGINS, P. W. MORRIS, H. REID, JR., R. J. STEIN, and J. E. ZIMMERMAN
Aug. 1980
M-FS-23720 **Vol. 5, No. 1, p. 47**
Detector, intended for use with longwall shearer, determines when cut has pierced through coal layer. Accelerometer measures hardness of material struck by penetrometer ram, while reflectometers measure reflectivity of surface on either side of penetrometer. Signals are combined in voting circuit that indicates 'coal' or 'shale', depending on information supplied by three sensors. It distinguishes by differences in accelerometer waveforms.

B80-10062
FAST-RESPONSE ATMOSPHERIC-POLLUTANT MONITOR
D. I. SEBACHER
Aug. 1980 See also NASA-TP-1113 (N78-13408)
LANGLEY-12317 **Vol. 5, No. 1, p. 48**
Fast infrared spectrometer measures atmospheric CO, CH_4, and HCl over range of 1 to 12 ppm. With modifications it could measure other pollutants and use natural light as source. Cell filled with sample to be measured filters out spectral lines of interest. Infrared beam passes through rotating cell holder that produces chopped signals at two frequencies. Difference in signal amplitudes depends on amount of test gas in sample. Signal processing circuitry amplifies and separates test-gas and reference signals.

B80-10063
FIRE TESTS FOR AIRPLANE INTERIOR MATERIALS
E. A. TUSTIN (Boeing Co.)
Aug. 1980 See also NASA-CR-145658 (N79-19112)
MSC-18478 **Vol. 5, No. 1, p. 49**
Large scale, simulated fire tests of aircraft interior materials

were carried out in salvaged airliner fuselage. Two 'design' fire sources were selected: Jet A fuel ignited in fuselage midsection and trash bag fire. Comparison with six established laboratory fire tests show that some laboratory tests can rank materials according to heat and smoke production, but existing tests do not characterize toxic gas emissions accurately. Report includes test parameters and test details.

B80-10064
REDOX ELECTROCHEMICAL ENERGY STORAGE
L. H. THALLER
Aug. 1980 See also NASA-TM-X-71540 (N74-21688)
LEWIS-13398 **Vol. 5, No. 1, p. 50**

Reservoirs of chemical solutions can store electrical energy with high efficiency. Reactant solutions are stored outside conversion section where charging and discharging reactions take place. Conversion unit consists of stacks of cells connected together in parallel hydraulically, and in series electrically. Stacks resemble fuel cell batteries. System is 99% ampere-hour efficient, 75% watt hour efficient, and has long projected lifetime. Applications include storage buffering for remote solar or wind power systems, and industrial load leveling. Cost estimates are $325/kW of power requirement plus $51/kWh storage capacity. Mass production would reduce cost by about factor of two.

B80-10065
ADDITIVE IMPROVES ENGINE-OIL PERFORMANCE
A. J. BABECKI and H. C. FLETCHER
Aug. 1980
GSFC-12327 **Vol. 5, No. 1, p. 51**

Tests of metal erosion in operating engines show that addition of 5% tricresyl phosphate significantly reduces wear rate. Commercial 10W30 oil gives one tenth wear and degrades less with additive.

B80-10066
DRILLING SIDE HOLES FROM A BOREHOLE
E. R. COLLINS, JR. (Caltech)
Aug. 1980
NPO-14465 **Vol. 5, No. 1, p. 52**

Machine takes long horizontal stratum samples from confines of 21 cm bore hole. Stacked interlocking half cylindrical shells mate to form rigid thrust tube. Drive shaft and core storage device is flexible and retractable. Entire machine fits in 10 meter length of steel tube. Machine could drill drainage or ventilation holes in coal mines, or provide important information for geological, oil, and geothermal surveys.

B80-10067
CORROSION-RESISTANT CERAMIC THERMAL BARRIER COATING
P. E. HODGE, S. R. LEVINE, and R. A. MILLER
Aug. 1980
LEWIS-13088 **Vol. 5, No. 1, p. 53**

Two-layer thermal barrier coating, consisting of metal-CrAlY bond coating and calcium silicate ceramic outer layer, greatly improves resistance of turbine parts to hot corrosion from fuel and air impurities. Both layers can be plasma sprayed, and ceramic layer may be polished to reduce frictional losses. Ceramic provides thermal barrier, so parts operate cooler metal temperatures, coolant flow can be reduced, or gas temperatures increased. Lower grade fuels also can be used.

B80-10068
REDUCING STATIC CHARGES IN FLUIDIZED BED REACTIONS
T. WYDEVEN, E. V. BALLOU (San Jose State Univ. Foundation), P. C. WOOD (San Jose State Univ. Foundation), and L. A. SPITZE (San Jose State Univ.)
Aug. 1980
ARC-11245 **Vol. 5, No. 1, p. 54**

Radio frequency glow discharge apparatus ionizes fluidizing gas, making it conductive enough to neutralize static charge on fluidized particles. Particles agglomerate less, and in one case reactant loading capacity was increased six fold.

B80-10069
TRANSFERRING SMALL SAMPLES OF VISCOUS LIQUID
B. W. MILLER (Rockwell International Corp.), S. M. MITCHELL (Rockwell International Corp.), and J. N. OLNEY (Rockwell International Corp.)
Aug. 1980
MSC-18533 **Vol. 5, No. 1, p. 55**

To avoid trapped air bubbles, fluid after removing plunger. Plunger is reinserted, syringe inverted, and air bubbles expelled by depressing plunger. Technique makes it easy to control sample quantities as small as one microliter, without problems from bubbles created by plunger suction.

B80-10070
COAL CONVERSION AND SYNTHETIC-FUEL PRODUCTION
R. BRADFORD, W. T. ATKINS (BDM Corp.), R. M. BASS (BDM Corp.), R. DASCHER (BDM Corp.), J. DUNKIN (BDM Corp.), N. LUCE (BDM Corp.), W. SEWARD (BDM Corp.), and D. WARREN (BMD Corp.)
Aug. 1980
M-FS-25330 **Vol. 5, No. 1, p. 56**

Report evaluates potential coal gasification and synthetic-fuel production technologies for 1985 to 1990. Book includes overview of present and future technical and economic potential, ways of evaluating gasification facility designs, discussion of promising processes, characterization of potential markets, and list of available gasification systems.

B80-10071
UNDERGROUND COAL MINING
G. M. HILL (Caltech)
Aug. 1980
NPO-14704 **Vol. 5, No. 1, p. 56**

Computer program models coal-mining production, equipment failure and equipment repair. Underground mine is represented as collection of work stations requiring service by production and repair crews alternately. Model projects equipment availability and productivity, and indicates proper balance of labor and equipment. Program is in FORTRAN IV for batch execution; it has been implemented on UNIVAC 1108.

B80-10204
A TEMPERATURE FIXED POINT NEAR 58 C
M. E. GLICKSMAN (Rensselaer Polytech. Inst.)
Sep. 1980
M-FS-25304 **Vol. 5, No. 2, p. 179**

Triple-point cell contrains about 300 g of high-purity succinontrile. Experiments show that lower 4 cm of thermometer well are virtually isothermal, making placement of thermometer not very critical. Bulb at bottom of well helps to prevent solid succinontrile mantel from slipping.

B80-10205
REMOVAL OF HYDROGEN BUBBLES FROM NUCLEAR REACTORS
R. V. JENKINS
Sep. 1980
LANGLEY-12597 **Vol. 5, No. 2, p. 180**

Method proposed for removing large hydrogen bubbles from nuclear environment uses, in its simplest form, hollow spheres of palladium or platinum. Methods would result in hydrogen bubble being reduced in size without letting more radioactivity outside reactor.

B80-10206
PLASTICIZER FOR POLYMIDE COMPOSITES
T. L. ST. CLAIR (V.P.I.&State Univ.) and J. M. BUTLER
Sep. 1980
LANGLEY-12642 **Vol. 5, No. 2, p. 180**

Problem of maintaining good prepreg tack and drape has been solved by modification of addition polymide. Tack and drape are ability of prepreg to adhere to adjacent plies and to conform to desired shape during layup process. Alternate approach allows both longer life of polymer prepreg and processing of low-void laminates. It appears to be applicable to all addition polymide systems. Modified addition polymide takes advantage of reactive

liquid plasticizer, monoethylphthalate, which is used in place of solvent. Because of low vapor pressure of reactive liquid, it is retained and, thereby, tack and flexibility of prepreg are retained.

B80-10207
IMPROVED ADHERENCE OF T1C COATINGS TO STEEL
W. A. BRAINARD and D. R. WHEELER
Sep. 1980 See also NASA TP-1377(N79-15184)
LEWIS-13169 **Vol. 5, No. 2, p. 181**

Modified process for RF sputtering of titanium carbide coatings onto 440-C steel has resulted in improved adherence. Small partial pressure of nitrogen, approximately 0.5 percent, during first minutes of deposition marked by improved adherence, friction, and wear properties when compared with coatings applied on sputter-etched surfaces, or oxidized surfaces or in presence of small oxygen partial pressure. X-ray photoelectron spectroscopy and X-ray diffraction were used to characterize resultant coatings.

B80-10208
HYBRID POLYMER MICROSPHERES
A. REMBAUM (Caltech)
Sep. 1980
NPO-14462 **Vol. 5, No. 2, p. 182**

Techniques have been successfully tested for bonding polymeric spheres, typically 0.1 micron in diameter, to spheres with diameter up to 100 microns. Hybrids are being developed as improved packing material for ion-exchange columns, filters, and separators.

B80-10209
COMPOSITES FOR AEROPROPULSION
G. M. AULT and J. C. FRECHE
Sep. 1980
LEWIS-13438 **Vol. 5, No. 2, p.183**

Report summarizes status of composite materials for aeropropulsion. It describes key advances made in past several years and lists 47 references published from 1971 to 1979.

B80-10210
LUBRICATION HANDBOOK
Innovator not given(Midwest Res. Inst.) Sep. 1980
M-FS-25158 **Vol. 5, No. 2, p. 183**

Handbook is divided into two major parts: solid lubricants and liquid lubricants used in aerospace industry. Listed materials cover broad application spectrum from manufacturing and ground support to missile and spacecraft hardware. Handbook can serve as ready reference in design and maintenance service of industrial equipment.

B80-10211
METHANE/AIR FLAMES IN A CONCENTRIC TUBE COMBUSTOR
N. C. MARKATOS (Concentration, Heat and Momentum Ltd.), D. B. SPALDING (Concentration, Heat and Momentum Ltd.), and S. K. SRTVATSA (Concentration, Heat and Momentum Ltd.)
Sep. 1980
LEWIS-13388 **Vol. 5, No. 2, p. 184**

Computer program gives realistic prediction of hydrodynamics and chemical reaction in reverse-flow two-concentric-tube combuster. Special attention is given to formation of oxides of mitrogen in combustion process. Program is written in FORTRAN IV for batch execution.

B80-10350
HEAT RESISTANT POLYPHOSPHAZENE POLYMERS
L. L. FEWELL, H. R. ALLCOCK (Pennsylvania State Univ.), J. P. OBRIEN (Pennsylvania State Univ.), and A. G. SCOPELIANOS (Pennsylvania State Univ.)
Jan. 1981
ARC-11176 **Vol. 5, No. 3, p. 319**

Polymers of carboranyl substituted polyphosphazene are stable at high temperatures and produce insulating char upon pyrolysis. Substituted compounds are prepared by heat polymerizing carboranyl halophosphazene, which is obtained by reacting lithium carborane with, for example, hexachlorocyclotriphosphazene under anhydrous conditions. Chlorine of polymer may be replaced by aryloxy and alkoxy groups.

B80-10351
OXIDE DISPERSION STRENGTHENED SUPERALLOY
T. K. GLASGOW, Y. G. KIM (Inco R and D Ctr.), L. R. CURWICK (Inco R and D Ctr.), and H. F. MERRICK (Inco R and D Ctr.)
Jan. 1981 See also NASA-CR-135150(N77-22213); NASA-CR-159493(N80-13218); NASA-TM-79088(N79-20180)
LEWIS-13589 **Vol. 5, No. 3, p. 320**

MA6000E alloy is strengthened at high temperatures by dispersion of yttrium oxide. Strength properties are about twice those of conventional nickel base alloys. Good thermal fatigue, intermediate temperature strength, and good oxidation resistance give alloy unique combination of benefits. Application in aircraft gas turbine is improved.

B80-10352
LOW COST HIGH TEMPERATURE, DUPLEX COATING FOR SUPERALLOYS
S. G. YOUNG and D. L. DEADMORE
Jan. 1981 See also NASA-TM-79178(N79-29292)
LEWIS-13497 **Vol. 5, No. 3, p. 321**

Duplex silicon-slurry/aluminide coating substantially improves high temperature resistance to oxidation and corrosion of nickel base alloys. Coating used in critical sections of power systems like turbojet engines extends their operating capabilities.

B80-10353
IMPROVED METALLIC AND THERMAL BARRIER COATINGS
S. STECURA
Jan. 1981 See also NASA-TM-79206(N7929293); NASA-TM-78976(N78-31212)
LEWIS-13324 **Vol. 5, No. 3, p. 321**

Low thermal conductivity two layer ceramic coatings are efficient thermal barriers between cooled matallic components and high temperature combustion gases. Potential components are combustors, blades, and vanes in aircraft engines of power-generating turbines. Presence of two layer coatings greatly reduces temperature and coolant requirements.

B80-10354
RESIN CHAR OXIDATION RETARDANT FOR COMPOSITES
K. J. BOWLES and R. E. GLUYAS
Jan. 1981 See also NASA-TM-79314(N80-14196); NASA-TM-79288(N80-13171)
LEWIS-13275 **Vol. 5, No. 3, p. 322**

Boron powder stabilizes char, so burned substances are shiny, smooth, and free of loose graphite fibers. Resin weight loss of laminates during burning in air is identical for the first three minutes for unfilled and boron-filled samples, then boron samples stabilize.

B80-10355
COMPOSITES WITH NEARLY ZERO THERMAL EXPANSION
T. J. DUNN, A. J. CWIERTNY, JR. (McDonnall Douglas Corp.), V. L. FREEMAN (McDonnell Douglas Corp.), and R. JOHNSON, JR. (McDonnell Douglas Corp.)
Jan. 1981 See also NASA-CR-160558(N80-19144)
MSC-18724 **Vol. 5, No. 3, p. 323**

Graphite, glass, and resin composite is very strong, stiff, and thermally stable. As mounting material for antennas, mirrors and lenses, composite minimizes structural distortion and misalignment. Rods of substance are made by pulling preimpregnated ribbon of glass and graphite through die. When materials are combined in proper proportion, graphite contracts, and glass and resin expand as temperature increases. Matrix for fiber may be polysulfane, epoxy, polyimide, or othe resin.

B80-10356
CARBON SCRUBBER
M. S. FRANT (Orion Res., Inc.)
Jan. 1981
MSC-16531 **Vol. 5, No. 3, p. 324**

Inorganic carbon is removed from samples to be analyzed

for 'total organic carbon'. In automated water analysis systems, semipermeable membrane separates two sample streams, one treated with acid, other with base. Carbonate and bicarbonated ions are converted to dissolved CO2 by acid; reverse process occurs in basic stream. Only CO2 is passed by membrane, from acid treated stream to base treated stream. Acidic stream emerges free of all inorganic carbon.

B80-10357
ELECTRICALLY CONDUCTIVE PALLADIUM-CONTAINING POLYIMIDE FILMS
A. K. ST.CLAIR, T. A. FURTSCH (VPI&SU), and L. T. TAYLOR (VPI&SU)
Jan. 1981
LANGLEY-12629 **Vol. 5, No. 3, p. 325**
Palladium addition makes light, flexible film with low resistivity to relieve space charging. Polyimide film is prepared in four steps: preparation of polyamic acid in polar solvent; addition of soluable palladium complex salt; fabrication of film of 'palladium polyamic acid' solution; and thermal imidization of film to palladium-containing polyimide by 300 C heating. Lowered resistivities were achieved without loss in film flexibility or increase in film weight.

B80-10358
ALUMINUM IONS ENHANCE POLYIMIDE ADHESIVE
A. K. ST.CLAIR, T. L. ST.CLAIR, and L. T. TAYLOR (VPI&SU)
Jan. 1981
LANGLEY-12640 **Vol. 5, No. 3, p. 326**
Adding complexed aluminum ions raises useful temperature of polyimide adhesive without embrittling it or reducing long term stability. Adhesives may be applied to prepared substrate surface without supports. Possible substrates are metal, composite, or polymeric film. Adhesive is excellent where bond flexibility is required.

B80-10359
SIMULTANEOUS MEASUREMENT OF THREE ATMOSPHERIC POLLUTANTS
M. P. SINHA (Caltech)
Jan. 1981
NPO-14828 **Vol. 5, No. 3, p. 327**
Method enables simultaneous concentration monitoring of atmospheric SO2, NO, and NO2. Fluorescing pollutant gases in sample are excited by visible output of dye laser and its second-harmonic ultraviolet frequencies. Three photomultipliers, each with suitable optical filters, view fluorescence. Method tests ambient air, stack emissions, and highway automotive exhausts.

B80-10360
AEROSOL LASTS UP TO SIX MINUTES
M. A. APPEL (Caltech)
Jan. 1981
NPO-14947 **Vol. 5, No. 3, p. 328**
Simple aerosol generator catalytically converts hydrogen peroxide to super-heated steam and then mixes steam with dye. Highly visible mist lasts for 6 minutes and can be used to study aerodynamic turbulence. Method does not depend on formation of ice crystals at cold high altitudes and is environmentally safe.

B80-10361
HIGH CHAR YIELD EPOXY CURING AGENTS
P. DELVIGS, T. T. SERAFINI, and R. D. VANUCCI
Jan. 1981 See also NASA-TM-79226(N79-29240)
LEWIS-13226 **Vol. 5, No. 3, p. 328**
Class of imide-amine curing agents preserves structural integrity, prevents fiber release, and is fully compatible with conventional epoxy resins; agents do not detract from composite properties while greatly reducing char yield. Materials utilizing curing are used in aerospace, automotive, and other structural components where deterioration must be minimized and fiber release avoided in event of fire.

B80-10362
CAP PROTECTS AIRCRAFT NOSE CONE
C. F. BRYAN, JR. and D. C. BRYAN
Jan. 1981
LANGLEY-12367 **Vol. 5, No. 3, p. 329**
Inexpensive, easily fabricated cap protects aircraft nose cone from erosion. Made of molded polycarbonate, cap has been flight tested at both subsonic and supesonic speeds. Its strength and erosion characteristics are superior to those of fiberglass cones.

B80-10363
LASER BEAM METHANE DETECTOR
E. D. HINKLEY, JR. (Caltech)
Jan. 1981
NPO-14929 **Vol. 5, No. 3, p. 330**
Instrument uses infrared absorption to determine methane concentration in liquid natural gas vapor. Two sensors measure intensity of 3.39 mm laser beam after it passes through gas; absorption is proportional to concentration of methane. Instrument is used in modeling spread of LNG clouds and as leak detector on LNG carriers and installations. Unit includes wheels for mobility and is both vertically and horizontally operable.

B80-10364
REDUCED HYDROGEN PERMEABILITY AT HIGH TEMPERATURES
J. R. STEPHENS, W. D. KLOPP, and J. A. MISENCIK
Jan. 1981
LEWIS-13485 **Vol. 5, No. 3, p. 331**
CO and CO2 reduce hydrogen loss through iron, nickel, and cobalt based alloy tubes. Method is based on concept that oxide film on metal surface reduces hydrogen permeability through metal; adding CO or CO2 forms oxide films continuously during operation, and hydrogen containment is improved. Innovation enhances prospects for Stirling engine system utilization.

B80-10365
CHLORINOLYSIS RECLAIMS RUBBER OF WASTE TIRES
E. R. DUFRESNE (Caltech), J. H. TERVET (Caltech), and G. G. HULL (Caltech)
Jan. 1981
NPO-14935 **Vol. 5, No. 3, p. 331**
Process reclaims rubber and reduces sulfur content by using chlorine gas to oxidize sulfur bonds in preference to other bonds. Rubber does not have poor hysteresis and abrasion resistance like conventionally reclaimed rubber and is suitable for premium radial tires. Chlorinated rubber is less susceptible to swelling by oils and may be used as paint ingredient.

B80-10366
REDUCED GRAVITY FAVORS COLUMNAR CRYSTAL GROWTH
T. Z. KATTAMIS (Grumman Aerospace Corp.) and J. M. PAPAZIAN (Grumman Aerospace Corp.)
Jan. 1981
M-FS-25205 **Vol. 5, No. 3, p. 332**
In zero gravity, alined columnar microstructures form at expense of equiaxed growth. Preferential crystal growth occurs in solidification chamber consisting of semicylindrical copper chill block brazed to stainless steel top plate. Method is best utilized in castings where directional dependence of physical properties is beneficial, as in turbine blades.

B80-10489
IMPROVED CELL FOR WATER-VAPOR ELECTROLYSIS
J. R. AYLWARD (United Technologies Corp.)
Apr. 1981
MSC-16394 **Vol. 5, No. 4, p. 447**
Continuous-flow electrolytic cells decompose water vapor in steam and room air into hydrogen and oxygen. Sintered iridium oxide catalytic anode coating yields dissociation rates hundredfold greater than those obtained using platinum black. Cell consists of two mirror-image cells, with dual cathode sandwiched between two anodes. Gas traverses serpentine channels within cell and is dissociated at anode. Oxygen mingles with gas stream, while hydrogen migrates through porous matrix and is liberated as gas at cathode.

B80-10490
APPLYING THE HELIUM IONIZATION DETECTOR IN CHROMATOGRAPHY
E. K. GIBSON, F. F. ANDRAWES (Lockheed Engineering and Management Services Co., Inc.), and R. S. BRAZELL (University of Houston)
Apr. 1981
MSC-18835 **Vol. 5, No. 4, p. 448**
High noise levels and oversensitivity of helium detector make flame-ionization and thermal-conductivity detectors more suitable for chromotography. Deficiencies are eliminated by modifying helium device to operate in saturation rather than multiplication mode. Result is low background current, low noise, high stability, and high sensitivity. Detector analyzes halocarbons, hydrocarbons, hydrogen cyanide, ammonia, and inorganics without requiring expensive research-grade helium.

B80-10491
PHOTOPRODUCTION OF HALOGENS USING PLATINIZED TIO2
B. REICHMAN (Christopher Newport College) and C. E. BYVIK
Apr. 1981
LANGLEY-12713 **Vol. 5, No. 4, p. 449**
Unlike electrolysis of halide salt solutions, technique using powdered titanium dioxide catalyst requires no external power other than ultraviolet radiation source. Semiconductor powders photocatalyze and photosynthesize many useful reactions; applications are production of halogen molecules, oxidation of hazardous materials in wastewater, and conversion of carbon monoxide to carbon dioxide.

B80-10492
RECYCLING PAPER-PULP WASTE LIQUORS
M. N. SARBOLOUKI (Caltech)
Apr. 1981
NPO-14797 **Vol. 5, No. 4, p. 450**
Papermills in U.S. annually produce 3 million tons of sulfite waste liquor solids; other fractions of waste liquor are monomeric sugars and lignosulfonates in solution. Recovery of lignosulfonates involves precipitation and cross-linking of sulfonates to form useful solid ion-exchange resin. Contamination of sugars recovered from liquor is avoided by first converting them to ethanol, then removing ethanol by distillation.

B80-10493
USER CHOOSES COATING PROPERTIES
C. S. GILLILAND and R. J. DUCKETT
Apr. 1981
LANGLEY-12719 **Vol. 5, No. 4, p. 451**
Anodizing technique allows independent selection of coating thermal emittance and solar absorption. Process has three phases: initial material processing, which prepares material and establishes initial values of emittance and absorption; anodizing with chromic acid solution, which determines final values; and material postprocessing. Stability tests show less than 15 percent coating degradation over 2,000 hour solar exposure.

B80-10494
REMOVING FREON GAS FROM HYDRAULIC FLUID
B. B. WILLIAMS (Rockwell International Corp.), S. M. MITCHELL (Rockwell International Corp.), and T. S. STATE (Rockwell International Corp.)
Apr. 1981
MSC-18740 **Vol. 5, No. 4, p. 452**
Dissolved freon gas is removed from hydraulic fluid by raising temperature to 150 F and bubbling dry nitrogen gas through it, even while fluid circulates through hydraulic system. Procedure reduces parts corrosion, sludge formation, and contamination.

B80-10495
NEW PRESSURE-SENSITIVE SILICONE ADHESIVE
J. L. LEIFFER, W. E. STOOPS, JR., T. L. ST. CLAIR, V. E. WATKINS, JR., and T. P. KELLY
Apr. 1981
LANGLEY-12737 **Vol. 5, No. 4, p. 452**
Adhesive for high or low temperatures does not stretch severely under load. It is produced by combining intermediate-molecular-weight pressure sensitive adhesive which does not cure with silicone resin that cures with catalyst to rubbery tack-free state. Blend of silicone tackifier and cured rubbery silicone requires no solvents in either atmospheric or vacuum environments. Ratio of ingredients varies for different degrees of tack, creep resistance, and tensile strength.

B80-10496
DRIVING BUBBLES OUT OF GLASS
D. M. MATTOX (Westinghouse Electric Corp.)
Apr. 1981
M-FS-25414 **Vol. 5, No. 4, p. 453**
Surface tension gradient in melt forces gas bubbles to surface, increasing glass strength and transparency. Conventional chemical and buoyant fining are extremely slow in viscous glasses, but tension gradient method moves 250 um bubbles as rapidly as 30 um/s. Heat required for high temperature part of melt is furnished by stationary electrical or natural-gas heater; induction and laser heating are also possible. Method has many applications in industry processes.

B80-10497
LESS-TOXIC CORROSION INHIBITORS
T. S. HUMPHRIES
Apr. 1981 See also NASA-TP-1279(N78-28226)
M-FS-25496 **Vol. 5, No. 4, p. 453**
Combinations of borates, nitrates, phosphates, silicates, and sodium MBT protect aluminum from corrosion in fresh water. Most effective combinations contained sodium phosphate and were alkaline. These inhibitors replace toxic chromates which are subject to governmental restrictions, but must be used in larger quantities. Experimental exposure times varied from 1 to 14 months depending upon nature of submersion solution.

B80-10498
DIFFUSION IN SINGLE-PHASE BINARY ALLOYS
D. R. TENNEY and J. UNNAM (VPI and State University)
Apr. 1981
LANGLEY-12665 **Vol. 5, No. 4, p. 454**
DBAS 1 computer program provides analyst with simple algorithms for exact rapid solutions of systems with planar, cylindrical, or spherical interfaces. Conventional solutions are complex and present convergence problems. Two algorithm types are figured for each geometry; one converges rapidly for short and the other for long diffusion times. DBAS 1 is written in FORTRAN IV for batch execution.

05 LIFE SCIENCES

B80-10072
TEMPERATURE CONTROLLER FOR HYPERTHERMIA DEVICES
R. H. COUCH, C. P. HEARN, and J. B. WILLIAMS
Aug. 1980
LANGLEY-12528 **Vol. 5, No. 1, p. 59**
Temperature controller monitors and controls temperature in local region of tumor. Medical grade thermocouples are inserted in or near tumor, controller pulse modulates radio frequency diathermy power source to maintain temperature within 0.2 C. System may be extended to control diathermy of more than one tumor or patient.

B80-10073
MEASURING WATER/PROPERTIES FROM A MOVING BOAT
A. G. LAWSON
Aug. 1980
LANGLEY-12325 **Vol. 5, No. 1, p. 60**
Modification of commercial water analyzer permits measure-

ment of pH, temperature, dissolved oxygen, conductivity, and turbidity for continuous water flow. Ram pressure on inlet tube mounted below power boat drives water through modified sample chamber where it is analyzed.

B80-10212
TESTING EKG ELECTRODES ON-LINE
W. G. CROSIER (Technol., Inc.) and G. S. RUTT (Technol., Inc.)
Sep. 1980
MSC-18696 **Vol. 5, No. 2, p. 187**
Simple test instrument allows electrocardiograph operator to check individual electrodes while they are attached to subject. Simply by rotating switch and observing meter, operator verifies that each electrode is not short-circuited or open-circuited and does not present excessive contact resistance at its interface with skin. Instrument also makes it convenient to check electrode cables that are subject to frequent bending and wear, such as cables used on patients who are exercising.

B80-10213
LASER-FLUORESCENCE MEASUREMENT OF MARINE ALGAE
E. V. BROWELL
Sep. 1980 See also NASA TND-8447(N77-26480)
LANGLEY-12282 **Vol. 5, No. 2, p. 187**
Progress in remote sensing of algae by laser-induced fluorescence is subject of comprehensive report. Existing single-wavelength and four-wavelength systems are reviewed, and new expression for power received by airborne sensor is derived. Result differs by as much as factor of 10 from those previously reported. Detailed error analysis evaluates factors affecting accuracy of laser-fluorosensor systems.

B80-10367
FLOW SENSOR FOR BIOMEDICAL FLUIDS
H. E. WINKLER
Jan. 1981 See also B78-10267
MSC-18761 **Vol. 5, No. 3, p. 335**
Electronic sensor accurately measures and controls flow of plasma, whole blood, or drugs in solution. Since sensor does not directly contact fluid, it does not have to be sterilized. It is compatible with disposable bottles, tubes, and hypodermic needles widely used in hospitals. Only modification necessary is in tube, which must contain two small metal inserts, spaced to fit in curved thermistor plates.

B80-10368
TREATING DOMESTIC WASTEWATER WITH WATER HYACINTHS
R. C. MCDONALD (Natl. Space Sci. Lab.) and B. C. WOLVERTON
Jan. 1981
M-FS-23964 **Vol. 5, No. 3, p. 336**
Greenhouse system purifies water, extracts fertilizers, and generates fuels. When fully developed, system may supplant septic tanks and central sewage for rural and underdeveloped areas.

B80-10369
COMPLIANT TRANSDUCER MEASURES ARTERY PROFILE
C. FELDSTEIN (Caltech), V. H. CULLER (Caltech), D. W. CRAWFORD (So. Calif. Univ.), and J. R. SPEARS (So. Calif. Univ.)
Jan. 1981
NPO-14899 **Vol. 5, No. 3, p. 337**
Instrument consisting of compliant fingers with attached semiconductor pickups measures inside contours of narrow vessels. Instrument, originally designed to monitor human arteries, is drawn through vessel to allow finges to follow contours. Lead wires transmit electrical signals to external processing equipment.

B80-10370
IMPROVED URETERAL STONE FRAGMENTATION CATHETER
P. M. GAMMELL (Caltech)
Jan. 1981
NPO-14745 **Vol. 5, No. 3, p. 337**
Catheter includes fiber optic viewer, more reliable ultrasonic probe, and better contact sensor. It is guided by four steering wires, and irrigation fluid is supplied through lumen to remove stone fragments.

B80-10371
MINIATURIZED PHYSIOLOGICAL DATA TELEMETRY SYSTEM
W. M. PORTNOY (Texas Tech. univ.) and L. J. STOTTS (Texas Tech. Univ.)
Jan. 1981 See also NASA-CR-160660(N80-24357)
MSC-18804 **Vol. 5, No. 3, p. 338**
Portable digital physiological data telemetry system uses less power, is more compact, and provides better data integrity than two previous systems designed to similar specifications. It has 13 data channels and two-way voice communication.

B80-10372
MANUAL FOR PHYSICAL FITNESS
A. E. COLEMAN (Univ. of Houston)
Jan. 1981 See also NASA-CR-160758(N80-29024)
MSC-18915 **Vol. 5, No. 3, p. 339**
Training manual used for preflight conditioning of NASA astronauts is written for audience with diverse backgrounds and interests. It suggests programs for various levels of fitness, including sample starter programs, safe progression schedules, and stretching exercises. Related information on equipment needs, environmental coonsiderations, and precautions can help readers design safe and effective running programs.

B80-10499
CARDIOPULMONARY DATA-ACQUISITION SYSTEM
W. G. CROSIER and R. A. REED
Apr. 1981 See also NASA-CR-160608(N80-33083); NASA-CR-160609(N80-33084); B80-10501
MSC-18783 **Vol. 5, No. 4, p. 457**
Computerized system controls and monitors bicycle and treadmill cardiovascular stress tests. It acquires and reduces stress data and displays heart rate, blood pressure, workload, respiratory rate, exhaled-gas composition, and other variables. Data are printed on hard-copy terminal every 30 seconds for quick operator response to patient. Ergometer workload is controlled in real time according to experimental protocol. Collected data are stored directly on tape in analog form and on floppy disks in digital form for later processing.

B80-10500
MICROPROCESSOR-CONTROLLED ULTRASONIC PLETHYSMOGRAPH
P. K. BHAGAT (University of Kentucky) and V. C. WU (University of Kentucky)
Apr. 1981
MSC-18759 **Vol. 5, No. 4, p. 458**
Safe, nonintrusive microprocessor system times ultrasonic pulses to measure limb cross-sectional area. Simple instrument requires no calibration and does not confine leg movement, making tests relating limb volume to activity level possible. Program considers more realistic geometries of human limb than circular cross-sections and monitors changes in area with great accuracy. Errors due to body temperature changes and timing roundoff are insignificant.

B80-10501
MICROPROCESSOR-BASED CARDIOTACHOMETER
W. G. CROSIER (Technology, Inc.) and J. A. DONALDSON (Technology, Inc.)
Apr. 1981 See also NASA-CR-160607(N80-33082);B80-10499
MSC-18775 **Vol. 5, No. 4, p. 459**
Instrument operates reliably even with stress-test electrocardiogram (ECG) signals subject to noise, baseline wandering, and amplitude change. It records heart rate from preamplified, single-lead ECG input signal and produces digital and analog heart-rate outputs which are fed elsewhere. Analog hardware processes ECG input signal, producing 10-ms pulse for each heartbeat. Microprocessor analyzes resulting pulse train, identifying

irregular heartbeats and maintaining stable output during lead switching. Easily modified computer program provides analysis.

B80-10502
IMPROVED MICROBE DETECTION IN WATER SAMPLES
J. R. WILKINS, D. C. GRANA, and S. C. FOX (The Bionetics Corp.)
Apr. 1981
LANGLEY-12709 **Vol. 5, No. 4, p. 460**
Method combines membrane filtration and electrochemical microbial detection. Together, techniques give fast response and accurate detection of low concentrations. Membrane filter placed on moistened absorbent pad collects cells; platinum-wire electrodes are positioned on filter surface. Second moistened pad is placed on top of electrodes and filter. Retainer ring maintains constant pressure and close contact between system components which are held in petri dish to reduce moisture loss.

B80-10503
GAGE FOR EVALUATING RHEUMATOID HANDS
J. C. HOUGE (University of Wisconsin) and K. A. PLAUTZ (University of Wisconsin)
Apr. 1981
GSFC-12610 **Vol. 5, No. 4, p. 461**
Two-axis goniometer accurately measures movements of fingers about knuckle joints, diagnosing hands structurally changed by rheumatoid arthritis. Instrument measures lateral movement which is small in normal knuckles but increased in diseased joints. Goniometer is two connected protractors that simultaneously measure angles in perpindicular planes. Dials are offset to clear bony protuberances; extension and offset adjustments span any hand size.

B80-10504
FIBER-OPTICS COUPLE ARTHROSCOPE TO TV
J. M. FRANKE and D. B. RHODES
Apr. 1981
LANGLEY-12718 **Vol. 5, No. 4, p. 462**
Convenient, hand-held coupler images output of arthroscope onto coherent fiber bundle. Arthroscope allows surgeons to examine internal organs through any small opening in body. Coupler is also used for engine inspection, instrument repair, and around-corner visual inspection. Image from arthroscope travels along flexible bundle and appears at other cable end where it is recollimated by lens. Image is read from lens or projected on color TV camera.

B80-10505
BEEF GRADING BY ULTRASOUND
P. M. GAMMELL (Caltech)
Apr. 1981
NPO-14812 **Vol. 5, No. 4, p. 463**
Reflections in ultrasonic A-scan signatures of beef carcasses indicate USDA grade. Since reflections from within muscle are determined primarily by fat/muscle interface, richness of signals is direct indication of degree of marbling and quality. Method replaces subjective sight and feel tests by individual graders and is applicable to grade analysis of live cattle.

06 MECHANICS

B80-10074
CABLE-SPLICE DETECTOR
R. D. LEE, E. J. IUFER, and A. GIOVANNETTI
Aug. 1980
ARC-11291 **Vol. 5, No. 1, p. 63**
Detector has possible uses in aerial cable-car systems, equipment handling in mines, boreholes, and undersea operations, and other applications where moving steel cable must be measured, monitored, or controlled. Detector consists of Hall-effect magnetic sensor located close to cable. Magnetic markings on cable are converted to electrical signals. Signals are filtered, amplified, and can actuate alarm.

B80-10075
LVDT GAGE FOR FRACTURE-TOUGHNESS TESTS IN LIQUID HYDROGEN
W. S. PIERCE and J. L. SHANNON, JR.
Aug. 1980
LEWIS-13038 **Vol. 5, No. 1, p. 64**
Linear-variable differential transformer replaces conventional resistance strain gages to measure crack-mouth-opening displacement. LVDT is superior in tests under liquid hydrogen, where boiling of hydrogen on resistive is suited to broad temperature range and hostile environments such as nuclear reactors.

B80-10076
TENSION-MODE LOADING FOR BEND SPECIMENS IN CRYOGENS
W. S. PIERCE and J. L. SHANNON, JR.
Aug. 1980
LEWIS-13040 **Vol. 5, No. 1, p. 65**
Special fixture permits use of tension-loading apparatus in fracture-toughness tests on standard bend specimens. Specimen is held in place by spacer blocks and wire clips. Central, load-application roller bends specimen between lateral, reaction-load rollers.

B80-10077
MODIFIED DISPLACEMENT GAGE FOR CRYOGENIC TESTING
W. S. PIERCE
Aug. 1980 See also NASA-TN-D-3724 (N67-10749)
LEWIS-13039 **Vol. 5, No. 1, p. 66**
Modification of double-cantilever-beam resistance strain gage makes boiling of hydrogen on gage arms less of problem. Modified gages are encapsulated nickel/chromium alloy, and bridge-excitation voltage is reduced from 10 to 1.5 volts. Sensitivity is 1.0 millivolt per inch with 1.5 volt excitation.

B80-10078
BROADBAND ELECTROSTATIC ACOUSTIC TRANSDUCER FOR LIQUIDS
J. H. CANTRELL, JR. (National Research Council), J. S. HEYMAN, M. A. BREAZEALE (Univ. of Tennessee), M. A. TORBETT (Univ. of Tennessee), and W. T. YOST (Univ. of Tennessee)
Aug. 1980
LANGLEY-12465 **Vol. 5, No. 1, p. 67**
Capacitive electrostatic transducer (ESAT) measures absolute displacement amplitudes of ultrasonic waves in liquids, and may be used as calibrator for other transducers or as probe for nondestructive study and characterization of materials. ESAT consists of thin conductive membrane stretched over metallic housing. Ultrasonic waves incident on membrane cause it to vibrate and generate signal proportional to wave amplitude. Entire assembly is sealed for immersion in liquid.

B80-10079
EDDY-CURRENT SENSOR MEASURES BOLT LOADING
M. E. BURR (Rockwell International Corp.)
Aug. 1980
M-FS-19486 **Vol. 5, No. 1, p. 68**
Thin wire welded to bottom of hole down center of bolt permits measurement of tension in bolt. Bolt lengthens under strain, but wire is not loaded, so gap between wire and eddy-current gap transducer mounted on bolt head indicates bolt loading. Eddy-current transducer could measure gap within 0.05 mm. Method does not require separate 'standard' for each bolt type, and is not sensitive to dirt or oil in bolt hole, unlike ultrasonic probes.

B80-10080
MULTIPLE-CREEP-TEST APPARATUS
C. L. HAEHNER

Aug. 1980
GSFC-12561 **Vol. 5, No. 1, p. 69**
Simplified, compact apparatus uses fixtures that can test three samples at once for flexure, compression, or double-shear creep. Each fixture uses series of rods and plates to divide one load equally among three samples. Fixtures could be expanded to carry more samples by adding more rods and plates.

B80-10081
COMPACT, SUPER HEAT EXCHANGER
A. FORTINI and J. M. KAZAROFF
Aug. 1980
LEWIS-12441 **Vol. 5, No. 1, p. 70**
Heat exchanger uses porous media to enhance heat transfer through walls of cooling channels, thereby lowering wall temperature. Porous media within cooling channel increases internal surface area from which heat can be transferred to coolant. Comparison data shows wall has lower temperature and coolant has higher temperature when porous medium is used within heat exchanger. Media can be sintered powedered metal, metal fibers, woven wire layers, or any porous metal having desired permeability and porosity.

B80-10082
APPLICATIONS OF REMOTE-SENSING IMAGERY
T. H. HUGHES (Univ. of Alabama)
Aug. 1980
M-FS-25107 **Vol. 5, No. 1, p. 71**
Compilation of reports discusses usefulness of aircraft and satellite data in land-development projects. Landsat and Earth Resources Technology Satellites data are available to general public. Much information on biological, geological, and hydrological features as well as land use can be determined by eye without sophisticated analyzers.

B80-10083
EQUATIONS OF MOTION FOR COUPLED N-BODY SYSTEMS
H. P. FRISCH
Aug. 1980
GSFC-12407 **vol. 5, No. 1, p. 72**
Computer program, developed to analyze spacecraft attitude dynamics, can be applied to large class of problems involving objects that can be simplified into component parts. Systems of coupled rigid bodies, point masses, symmetric wheels, and elastically flexible bodies can be analyzed. Program derives complete set of non-linear equations of motion in vectordyadic format. Numerical solutions may be printed out. Program is in FORTRAN IV for batch execution and has been implemented on IBM 360.

B80-10084
VISCOUS CHARACTERISTICS ANALYSIS
R. V. JENKINS
Aug. 1980
LANGLEY-12598 **Vol. 5, No. 1, p. 72**
Program considers combustion and diffusive effects in analysis of supersonic, combustion-flow fields with imbedded subsonic regions. Effects of finite-rate chemistry, mixing, and wave propagation are linked together. Program handles up to 20 simultaneous shock waves. Some chemistry terms are computed for seven-species, eight-mechanism, hydrogen-and-air reaction scheme. Program is aid for supersonic-combustor development studies and is written in FORTRAN IV for batch execution on CYBER 175.

B80-10085
TRANSONIC AIRFOIL DESIGN CODE
F. BAUER (New York Univ.), P. GARABEDIAN (New York Univ.), and D. KORN (New York Univ.)
Aug. 1980
LANGLEY-12460 **Vol. 5, No. 1, p. 73**
Program aids in design of shockless airfoils, assists development of fuel-conserving, supercritical wings. Algorithm calculates approximate airfoil shape given prescribed pressure distribution. This allows design of families of transonic airfoils for use in aircraft wings or turbine and compressor blades. Program is written in FORTRAN IV for batch execution on CDC-6000.

B80-10086
IMPROVED MULTIELEMENT AIRFOIL ANALYSIS
G. W. BRUNE (The Boeing Co.) and J. W. MANKE (The Boeing Co.)
Aug. 1980
LANGLEY-12489 **Vol. 5, No. 1, p. 73**
Program is revised of NASA/Lockheed program to numerically analyze complex viscous flow about slotted airfoils. Airfoil to be analyzed can contain as many as 10 components with negative or positive overlap. Program is written in FORTRAN IV and Assembled for batch execution on CYBER 175 only.

B80-10087
AIRCRAFT EQUILIBRIUM SPIN CHARACTERISTICS
W. M. ADAMS, JR.
Aug. 1980
LANGLEY-12502 **Vol. 5, No. 1, p. 74**
Program provides analytic solutions to nonlinear equations of motion describing spin conditions. Stability characteristics also are determined. Program can be used to study effects of aerodynamic and inertial parameters on spin and could be modified to compute equilibrium conditions for steady maneuvers. Program is written in FORTRAN IV for batch execution on CYBER 173.

B80-10088
FLOW FIELD IN SUPERSONIC MIXED-COMPRESSION INLETS
A. R. BISHOP, J. D. HOFFMAN (Purdue Univ.), and J. VADYAK (Purdue Univ.)
Aug. 1980
LEWIS-13279 **Vol. 5, No. 1, p. 74**
Program uses method of characteristics for steady three-dimensional flow to calculate flow field in supersonic portion of mixed-compression aircraft inlet at non-zero angle of attack. Results agree well with experimental data except in regions of high viscous interaction. Flow field for variety of mixed-compression inlets can be calculated. Input includes geometry and attack of inlet. Output consists of list of parameters, solution planes, and description of shock waves. Program is written in FORTRAN IV for batch execution on CDC 6000-series.

B80-10089
SHELL THEORY AUTOMATED FOR ROTATIONAL STRUCTURES
J. KEY, V. S. GONAS (Grumman Aerospace Corp.), S. LEVINE (Grumman Aerospace Corp.), and P. OGILVIE (Grumman Aerospace Corp.)
Aug. 1980
M-FS-23027 **Vol. 5, No. 1, p. 74**
Package of numerical integration programs static, buckling, vibration, and plastic analysis on thin sheels of revolution. Sheels may be subjected to distributed loads, concentrated line loads, and thermal strain. Outputs include stresses, displacement, plastic strains, and vibration and buckling results. Program aids design of aircraft bodies, spacecraft, submarines, and storage tanks. Written in FORTRAN IV for batch execution, program has been implemented on UNIVAC 1108.

B80-10090
THREE-DIEMNSIONAL POTENTIAL FLOW
N. D. HALSEY (McDonnell Douglas Corp.) and J. L. HESS (McDonnell Douglas Corp.)
Aug. 1980 See also NASA-TM-80088 (N79-31142)
LANGLEY-12623 **Vol. 5, No. 1, p. 75**
Program calculates viscous effects on lift and pressure distribution for arbitrary-dimensional lifting configuration. Geometry package generates input data from reduced amount of user-supplied configuration data. Calculated inviscid and viscous lift and pressure distribution agree well with experimental data for variety of wings and wing/fuselages. Program is in FORTRAN IV for batch execution on CYBER 175.

B80-10091
FULL-COVERAGE FILM COOLING
P. L. MEITNER (U.S. Army Research and Technology Laboratories)
Aug. 1980
LEWIS-13249 **Vol. 5, No. 1, p. 75**
Program calculates coolant flow and wall temperatures of full-coverage film-cooled vanes or blades. Thermal barrier coatings may be specified on outer surfaces of blade. Program is written in FORTRAN IV for batch execution on UNIVAC 1100.

B80-10092
DISTURBANCE AMPLIFICATION RATES
A. J. SROKOWSKI, S. A. ORSZAG (Cambridge Hydrodynamics, Inc.), T. CEBECH (McDonnell Douglas), and K. KAUPS (McDonnell Douglas Corp.)
Aug. 1980
LANGLEY-12556 **Vol. 5, No. 1, p. 76**
Program computes incompressible linear stability characteristics for swept and tapered wings. Amplification rates of boundary-layer disturbances also are calculated. Program is useful in designing tapered, laminar-flow control wings incorporating suction to prevent boundary layer separation. Program is written in FORTRAN IV and Assembler for batch execution on CYBER 70-series.

B80-10214
AUTOMATIC THERMAL SWITCHES
J. W. CUNNINGHAM and L. D. WING
Sep. 1980
GSFC-12553 **Vol. 5, No. 2, p. 191**
Two automatic switches control heat flow from one thermally conductive plate to another. One switch permits heat flow to outside; other limits heat flow. In one switch, heat on conductive plate activates piston that forces saddle against plate. Heat carriers then conduct heat to second plate that radiates it away. After temperature is first plate drops, piston contracts and spring breaks thermal contact with plate. In second switch, action is reversed.

B80-10215
GROOVES REDUCE AIRCRAFT DRAG
M. J. WALSH
Sep. 1980
LANGLEY-12599 **Vol. 5, No. 2, p. 192**
Aerodynamic drag can be reduced by many small longitudinal grooves machined in aircraft skin. Experiments show that grooves parallel to airflow reduce drag by 4 to 7 percent. Reduced drag translates into reduced engine power required to overcome drag and ultimately to lower fuel consumption.

B80-10216
EFFICIENT MEASUREMENT OF SHEAR PROPERTIES OF FIBER COMPOSITES
C. C. CHAMIS and J. H. SINCLAIR
Sep. 1980 See also NASA-TN-D-8215(N76-22314)
LEWIS-13011 **Vol. 5, No. 2, p. 193**
Intralaminar (in-plane) shear characterization (shear stress/ strain relationships) of unidirectional fiber composites has been hampered by difficulty of producing state of pure shear in practical paboratory test specimens. Proposed method uses 10 deg off-axis tensile specimen (fiber oriented 10 deg from load direction) in conjunction with simple transformation equations for intralaminar shear characterization of fiber composites.

B80-10217
FRESNEL LENSES FOR ULTRASONIC INSPECTION
C. C. KAMMERER (Rockwell Intern. Corp.)
Sep. 1980
MSC-18469 **Vol. 5, No. 2, p. 194**
Ultrasonic Fresnel lenses are effective focusing elements with potential applications in ultrasonic 'contact' testing for defects in materials. Ultrasonic beams focused on concave lenses are used successfully with immersion transducers, for which test object is immersed in water bath. However, for large objects, objects that are already installed, objects on production lines, and objects that can be damaged by water, contact testing is more practical than immersion.

B80-10218
CHANGES IN 'THERMAL LENS' MEASURE DIFFUSIVITY
A. GUPTA (Caltech), S. D. HONG (Caltech), and J. MOACANIN (Caltech)
Sep. 1980
NPO-14657 **Vol. 5, No. 2, p. 194**
In an extension of 'thermal lens' effect to new applications and better resolution, two laser beams combine to rapidly measure thermal diffusivity and other molecular dynamic properties. New double-beam technique handles very small samples unlike classical techniques for measuring diffusivity. It can be used for measurements on samples undergoing stress, making it applicable to data collection for structural engineering.

B80-10219
PASSIVE WING/STORE FLUTTER SUPPRESSION
J. T. FOUGHNER, JR., W. H. REED, III, and H. L. RUNYAN, JR. (George Washington Univ.)
Sep. 1980
LANGLEY-12468 **Vol. 5, No. 2, p. 195**
Passive flutter-suppression system has been developed to increase flutter speed of aircraft wings that are adversely affected by addition of large masses (stores) to the wings, such as external fuel tanks. Important features of system are its effectiveness for large variations in mass of store as well as unsensitivity of system to large change in location of store center-of-gravity.

B80-10220
SUPPRESSING BUZZ-SAW NOISE IN JET ENGINES
L. MAESTRELLO
Sep. 1980 See also NASA-TM-78802(N79-13820)
LANGLEY-12645 **Vol. 5, No. 2, p. 196**
Buzz-saw noise, most annoying noise component generated by turbofan engines, can be suppresses by installing porous surface on duct wall directly above engine fan-blade tip. Porous surface and its housing would reduce shock-wave reflection from wall and thus suppress noise.

B80-10221
DETECTION OF TANKER DEFECTS WITH INFRARED THERMOGRAPHY
A. G. KANTSIOS
Sep. 1980
LANGLEY-12655 **Vol. 5, No. 2, p. 196**
Infrared scanning technique for finding defects in secondary barrier of liquid natural gas (LNG) tank has been successfully tested on ship under construction at Newport News Shipbuilding and Dry Dock Company. Technique determines defects with minimal expenditure of time and manpower. Tests could be repeated during life of tanker and make more complicated testing unnecessary. Tests also confirmed that tank did not have any major defects, and tank was certified.

B80-10222
RECORDING FLUID CURRENTS BY HOLOGRAPHY
L. O. HEFLINGER (TRW, Inc.) and R. F. WUERKER (TRW, Inc.)
Sep. 1980
M-FS-25373 **Vol. 5, No. 2, p. 198**
Convection in fluids can be studied with aid of holographic apparatus that reveals three-dimensional motion of liquid. Apparatus eliminates images of fixed particles such as dust on windows and lenses, which might mask behavior of moving fluid particles. Holographic apparatus was developed for experiments on fluid convection cells under zero gravity. Principle is adaptable to study of variety of fluid processes-for example, electrochemical plating and combustion in automative engines.

B80-10223
DOWNHOLE PRESSURE SENSOR
C. M. BERDAHL (Caltech)
Sep. 1980
NPO-14729 **Vol. 5, No. 2, p. 199**
Sensor remains accurate in spite of varying temperatures. Very accurate, sensitive, and stable downhole pressure measurements are needed for vaiety of reservoir engineering applica-

tions, such as deep petroleum reservoirs, especially gas reservoirs, and in areas of high geothermal gradient.

B80-10224
OCEANIC-WAVE-MEASUREMENT SYSTEM
J. F. HOLMES (Computer Sci. Corp.) and R. T. MILES (Computer Sci. Corp.)
Sep. 1980
M-FS-23862 **Vol. 5, No. 2, p. 200**
Barometer mounted on bouy senses wave heights. As wave motion raises and lowers barometer, pressure differential is proportional to wave height. Monitoring circuit samples barometer output every half cycle of wave motion and adds magnitudes of adjacent positive and negative peaks. Resulting output signals, proportional to wave height, are transmitted to central monitoring station.

B80-10225
ELECTROFLUIDIC ACCELEROMETER
D. E. HEWES
Sep. 1980
LANGLEY-12493 **Vol. 5, No. 2, p. 201**
Electrofluidic accelerometer senses components of linear and angular acceleration field. Typical application of such acceleration is as active controlling element in airplane autopilot. In contrast to conventional accelerometers, electrofluidic accelerometer is lightweight, small, inexpensive, rugged, and requires little power. It consists of two temperature sensors on opposite sides of heating element. Sensors detect temperature gradient created by acceleration field on fluid; when device is accelerated, gradient changes because of bouyant force on hotter (thus lighter) portion of fluid.

B80-10226
FLASHBACK-FREE COMBUSTOR
S. G. ANDERSON and N. T. WAKELYN
Sep. 1980 See also NASA-TP-1472(N79-28259)
LANGLEY-12666 **Vol. 5, No. 2, p. 202**
All zirconia combustion chamber for testing fuels prevents 'flashback' accidental extension of flame into fuel supply line. Chamber consists of hemispherical injector on base surrounded by hemispherical cap. Cap has two additional ports for thermocouple and gas sampling probes.

B80-10227
MEASURING RADIATION EFFECTS ON MOS CAPACITORS
M. BAKOWSKI (Caltech), R. H. COCKRUM (Caltech), J. MASERJIAN (Caltech), and N. ZAMANI (Caltech)
Sep. 1980
NPO-14700 **Vol. 5, No. 2, p. 203**
Electron injection technique serves as powerful probe of trapped hole distribution after irradiation because it was determined that electrons only annihilate trapped holes. Other effects, such as other electron traps and interface state generation, are negligible in injection range used. Trap cross sections and densities indicate at least three trap species; interfacial species, dominant bulk species determined to tail off from silicon interface, and lower density and cross section species that may be distributed throughout bulk of oxide.

B80-10228
PREDICTING LIFETIME OF CAST PARTS
R. A. COOPER (Rockwell International Corp.)
Sep. 1980
M-FS-19549 **Vol. 5, No. 2, p. 204**
Life expectancy of cast aluminum machine parts can be predicted accurately from fatigue tests at 78 K on notched specimens of aluminum alloy. Method was developed for rocket engine turbopump parts made of high strength, heat treatable alloy with high silicon content; however, technique is applicable to other aluminum casting alloys.

B80-10229
DETECTING CONTAMINANTS BY ULTRAVIOLET PHOTOGRAPHY
D. W. NEISWANDER (Martin Marietta Corp.)
Sep. 1980
M-FS-25296 **Vol. 5, No. 2, p. 205**
Relatively high ultraviolet absorptivity of most organics as compared to metal is suggested as basis for detecting traces of contamination. By photographing metal surface in ultraviolet light, contaminants that might otherwise interfere with adhesion of surface coatings, or with welding or brazing, could be detected and removed. Real time monitoring of cleaning process is also possible if ultraviolet sensitive television camera is used instead of photographic film.

B80-10230
DETECTING SURFACE FAULTS ON SOLAR MIRRORS
M. J. ARGOUD (Caltech), M. S. SHUMATE (Caltech), W. L. WALKER (Caltech), and R. A. ZANTESON (Caltech)
Sep. 1980
NPO-14684 **Vol. 5, No. 2, p. 205**
Two quality control tests determine reflectivity and curvature faults of concave solar mirrors. Curvature defects in solar mirrors are easily revealed by photographing mirror surface. Calibrated aperture placed in front of camera lens admits rays reflecting only from acceptable areas of mirror, blocking out diverging rays reflected from defective areas. Defects can pinpoint problems that may exist in production. Same photograph can be obtained using calibrated disk instead of aperture, except that, this time, only defective areas would be exposed.

B80-10231
REFRACTION CORRECTIONS FOR SURVEYING
W. M. LEAR (TRW, Inc.)
Sep. 1980 See also TM-80803(N80-10907)
MSC-18664 **Vol. 5, No. 2, p. 206**
Optical measurements of range and elevation angles are distorted by refraction of Earth's atmosphere. Theoretical discussion of effect, along with equations for determining exact range and elevation corrections, is presented in report. Potentially useful in optical site surveying and related applications, analysis is easily programmed on pocket calculator. Input to equation is measured range and measured elevation; output is true range and true elevation.

B80-10232
DIGITAL ENHANCEMENT OF X-RAYS FOR NDT
R. L. BUTTERFIELD
Sep. 1980
KSC-11118 **Vol. 5, No. 2, p. 206**
Report is 'cookbook' for digital processing of industrial X-rays. Computer techniques, previously used primarily in laboratory and developmental research, have been outlined and codified into step by step procedures for enhancing X-ray images. Those involved in nondestructive testing should find report valuable asset, particularly is visual inspection is method currently used to process X-ray images.

B80-10233
DESIGN CONSIDERATIONS FOR MECHANICAL FACE SEALS
L. P. LUDWIG and H. F. GREINER (Sealol, Inc.)
Sep. 1980 See also NASA-TM-73735(N78-13439); NASA-TM-73736(N77-33518)
LEWIS-13146 **Vol. 5, No. 2, p. 207**
Two companion reports deal with design considerations for improving performance of mechanical face seals, one of family of devices used in general area of fluid sealing of rotating shafts. One report deals with basic seal configuration and other with lubrication of seal.

B80-10234
REGENERATIVE SUPERHEATED STEAM TURBINE CYCLES
L. C. FULLER (Union Carbide Corp.) and T. K. STOVALL (Union Carbide Corp.)
Sep. 1980
LEWIS-13392 **Vol. 5, No. 2, p. 208**
PRESTO computer program was developed to analyze performance of wide range of steam turbine cycles with special attention given to regenerative superheated steam turbine cycles.

It can be used to model standard turbine cycles, including such features as process steam extraction, induction and feedwater heating by external sources, peaking, and high back pressure. Expansion line efficiencies, exhaust loss, leakages, mechanical losses, and generator losses are used to calculate cycle heat rate and generator output. Program provides power engineer with flexible aid for design and analysis of steam turbine systems.

B80-10235
STREAM TUBE CURVATURE ANALYSIS
D. R. FERGUSON (GE) and J. S. KEITH (GE)
Sep. 1980
LANGLEY-11535 **Vol. 5, No. 2, p. 208**
Program accurately calculates inviscid pressure distribution and flow field, including viscous displacement effects, around arbitrary axisymmetric ducted body at transonic speeds. Computerized flow field analysis predicts transonic flow around long and short high bypass ratio fan duct nacelles with inlet and outlet flows having appropriate aerothermodynamic properties. It makes possible parametric studies for evaluating nacelle design criteria and selecting configurations for further experimental investigations.

B80-10236
A GENERALIZED VORTEX LATTICE METHOD
W. M. BAKER (Lockheed Aircraft Corp.), R. D. ELLIOTT (Lockheed Aircraft Corp.), and L. R. MIRANDA (Lockheed Aircraft Corp.)
Sep. 1980
LANGLEY-12636 **Vol. 5, No. 2, p. 209**
Several variations of vortex lattice method that are currently available have proved practical and versatile theoretical tools for aerodynamic analysis and design of planar and nonplanar configurations. Success of method is due in great part to relative simplicity of numerical technique involved and to accuracy of results obtained; however, most of available procedures are for subsonic flow applications. VORLAX program was developed to incorporate direct extension of vortex lattice method into supersonic flow regime, thus providing analyst with full flow range capability.

B80-10237
VIBRATION MODES AND FREQUENCIES OF STRUCTURES
R. J. DURLING and R. G. KVATERNIK
Sep. 1980
LANGLEY-12647 **Vol. 5, No. 2, p. 209**
SUDAN, Substructuring in Direct Analysis, analyzes natural modes and frequencies of vibration of structural systems. Based on direct method of analysis that employs substructures methodology, program is used with structures that may be represented as equivalent system of beam, springs, and rigid bodies.

B80-10238
PREDICTING PROPULSION SYSTEM DRAG
L. E. PUTNAM
Sep. 1980
LANGLEY-12619 **Vol. 5, No. 2, p. 210**
DONBOL computer program analytically predicts axisymmetric nozzle afterbody pressure distributions and drag. Predictions are based on Neumann solution for inviscid external flow coupled with modified Reshotko-Tucker integral boundary layer technique, control volume method of Presz for calculating flow in separated region, and inviscid one dimensional solution for jet exhaust flow. Comparisons with experimental data indicate program accurately predicts pressure distributions of boattail afterbodies for which jet exhaust plume can be simulated by solid body. For other configurations, nozzle pressure drag seems to be significantly underpredicted. Method is limited to subsonic free stream mach numbers below those for which flow over body becomes sonic.

B80-10239
HEAT CONDUCTION IN THREE DIMENSIONS
T. M. DANZA (Rockwell Intern. Corp.), L. W. FESLER (Rockwell Intern. Corp.), and R. D. MONGAN (Rockwell Intern. Corp.)
Sep. 1980
MSC-18616 **Vol. 5, No. 2, p. 210**
Multidimensional heat conduction program computes transient temperature history and steady state temperatures of complex body geometries in three dimensions. Emphasis is placed on type of problems associated with Space Shuttle thermal protection system, but program could be used in thermal analysis of most three dimensional systems.

B80-10373
HOLES HELP CONTROL TEMPERATURE
C. K. CHHATPAR (RCA Corp.)
Jan. 1981
GSFC-12618 **Vol. 5, No. 3, p. 343**
Study of passive thermal control for the Solar Terrestrial Subsatellite (STSS) has found that array of 'see through' holes substantially improves performance of system. Holes in payload mounting plates allow line of sight radiative heat transfer between hot and cold ends of spacecraft and between mounting plates and ends. Temperature gradients between plates are thereby reduced, as is temperature of each plate. Holes and selected exterior paints and finishes keep payload cool for all orientations and operating modes of STSS.

B80-10374
FAST RESPONSE CRYOGEN LEVEL SENSOR
J. B. FITZPATRICK (Simmonds Precision Products, Inc.) and L. C. MAIER (Simmonds Precision Products, Inc.)
Jan. 1981
MSC-18697 **Vol. 5, No. 3, p. 344**
Liquid level in cryogenic tank or pipe, or amount of gas trapped in pipeline flow, is monitored electronically by cylindrical capacitive sensor. Changes in liquid level between concentric tubes of capacitor change its impedance, varying current in drive circuit. Since it is oriented parallel to direction of liquid flow, sensor presents little resistance to moving fluid.

B80-10375
FIBER OPTIC LEVEL SENSOR FOR CRYOGENS
M. SHARMA (TRW, Inc.)
Jan. 1981
MSC-18674 **Vol. 5, No. 3, p. 345**
Sensor is useful in cryogenic environments where liquids of very low index of refraction are encountered. It is 'yes/no' indication of whether liquid is in contact with sensor. Sharp bends in fiber alter distribution of light among propagation modes. This amplifies change in light output observed when sensor contacts liquid, without requiring long fiber that would increse insertion loss.

B80-10376
ACOUSTIC LENS IS GAS-FILLED
J. M. KENDALL, JR. (Caltech)
Jan. 1981
NPO-14757 **Vol. 5, No. 3, p. 345**
Fluorocarbon gas contained by plastic membrane is effective lens for sound waves. In tests, lens substantially improved accuracy of sound 'maps' of turbulent airflow. It could also be used to record sound intensity patterns in design of speakers, lecture halls, and auditoriums. Lens is fabricated by clamping together two membranes of thin plastic and filling enclosed space with fluorocarbon gas. Since speed of sound in gas is considerably less than in air, lens refracts and focuses sound waves, analogous to focusing light by glass lens. Focal length is adjusted simply by changing gas pressure, which changes lens curvature.

B80-10377
ULTRASONIC FREQUENCY ANALYSIS
J. H. CANTRELL, JR. and J. S. HEYMAN
Jan. 1981
LANGLEY-12697 **Vol. 5, No. 3, p. 346**
Technique is used for evaluation and characterization of materials, fluids, and biological tissue. Method eliminates problem of electrical drive pulse shape by slaving tracking generator to local oscillator of spectrum analyzer. Logic/timing generator is used to control pulse transmission and receiving sequence, pulse width, and pulse repetition rate.

B80-10378
TEMPERATURE CONTROLLER ADAPTS TO FATIGUE TESTER
L. A. IMIG and M. R. GARDNER
Jan. 1981
LANGLEY-12393 **Vol. 5, No. 3, p. 347**
Identical blocks of aluminum, held against front and back of specimen, each contain electrical heaters, liquid nitrogen cavity with input and exhaust tubes, and thermocouple. Thermocouples are connected to control unit, which adjusts specimen temperature during fatigue tests over range of 850 degrees F.

B80-10379
ENVIRONMENTAL TESTING UNDER LOAD
R. K. CLARK and W. B. LISAGOR
Jan. 1981
LANGLEY-12602 **Vol. 5, No. 3, p. 348**
Inexpensive fixture applies compression loads to specimens exposed to environment. Fixture handles relatively large specimens suitable for postexposure analysis of physical, chemical, and mechanical properties.

B80-10380
TESTING PANELS IN TENSION AND FLEXURE
G. K. JING (Martin Marietta Corp.)
Jan. 1981
M-FS-25421 **Vol. 5, No. 3, p. 349**
Simple jig adapts tensile test machine for simulataneous application of tension and flexure, for evaluating panel composition, processing, and design. Environmental test chamber can be added so that panel properties can be measured at extreme temperatures.

B80-10381
A CONSTRUCTION TECHNIQUE FOR WIND TUNNEL MODELS
P. L. LAWING, P. G. SANDEFUR, JR., and W. H. WOOD
Jan. 1981
LANGLEY-12710 **Vol. 5, No. 3, p. 350**
High strength, good surface finish, and corrosion resistance are imparted to miniature wind tunnel models by machining pressure channels as integral part of model. Pattern for pressure channels is scribed, machined, or photoetched before channels are drilled. Mating surfaces for channels are flashed and then diffusion brazed together.

B80-10382
MEASURING THE THERMAL CONDUCTIVITY OF INSULATION
C. A. WILKINS (Caltech), R. ASH (Caltech), and W. L. DOWLER (Caltech)
Jan. 1981
NPO-14871 **Vol. 5, No. 3, p. 351**
Two symmetrical heat sources help determine thermal transmission properties of insulating material.

B80-10383
RAIN, FOG, AND CLOUDS FOR AIRCRAFT SIMULATORS
W. D. CHASE
Jan. 1981
ARC-11158 **Vol 5, No. 3, p. 352**
Environmental chamber creates realistic fog and rain effects in aircraft simulator. It reproduces clouds, homogeneous fog, patches of fog, rain and fog, and rain only. It is used with real time digital computer, color computer generated image display that simulates airport lights, or color television camera that produces moving display of airport runway as depicted on model terrain board.

B80-10384
IMPROVED MAGNETIC MATERIAL ANALYZER
J. E. TRINER
Jan. 1981 See also NASA-TM-79234 (N79-31499)
LEWIS-13493 **Vol. 5, No. 3, p. 353**
Flux-controlled magnetic-core-loss tester has been developed that produces high-frequency core-loss data (within 2 percent) for any desired waveform excitation and allows magnetic characteristics of material to be measured under symmetrical and asymmetrical excitation conditions. It allows direct control of additional loss variable rather than just driving frequency as is case for all previous sinusoidal core-loss measurements.

B80-10385
ELECTRONIC DEPTH MICROMETER
R. K. MAJOR (United Space Boosters, Inc.)
Jan. 1981
KSC-11181 **Vol. 5, No. 2, p. 354**
Device for measuring depth or thickness reads distance of penetration by small-diameter probe. It was developed specifically to measure thickness of wet (uncured) insulation applied to Space Shuttle structures; thin probes penetrate wet insulation to substrate, and reference surface on gage is then positioned against outer surface of insulation to measure its thickness. Gage is easy to use, even by workers wearing gloves or other protective clothing, and allows remote reading and recording of production data.

B80-10386
INTERCHANGEABLE SPRING MODULES FOR INERTIA MEASUREMENTS
J. W. MCNAMARA and J. W. OAKLEY
Jan. 1981
LANGLEY-12402 **Vol. 5, No. 3, p. 355**
Operation of inertia balance is simplified by packaging set of balance springs in interchangeable modules. They are held in place in balance pedestal by just two fasteners, making removal and replacement fast and simple. With them, balance can be readied in less than 15 minutes, in contrast to more than 2 hours by previous method.

B80-10387
WAKEFLOW ANALYSIS BY COST
V. J. ANSELMO (Caltech)
Jan. 1981
NPO-14705 **Vol. 5, No. 3, p. 355**
COST (Computerized Optical Scanning Tomography) is proposed for visualizing wakeflows of aircraft and wind-tunnel models. Operating very close to real time, COST hardware could be installed at airports to monitor turbulent flow trailing large aircraft, so that smaller aircraft could be directed to avoid turbulence. Real-time analysis of jet-engine exhaust plumes, to reduce pollution and optimize performance, is also possible.

B80-10388
INTEGRATED MATERIAL-SURFACE ANALYZER
F. J. GRUNTHANER (Caltech) and B. F. LEWIS (Caltech)
Jan. 1981
NPO-14702 **Vol. 5, No. 3, p. 356**
These 10 surface-analysis tests can be run without breaking vacuum: secondary-ion mass spectroscopy, ion-scattering spectroscopy, electron-stimulated desorption, residual-gas analysis, auger electron spectroscopy, x-ray photoelectron spectroscopy, ultraviolet photoelectron spectroscopy, characteristic-electron energy-loss spectroscopy, scanning electron microscope, scanning low-energy electron probe. Quadruple mass spectrometer, used in first 4 tests, serves as electron transfer lens in last 6 tests.

B80-10389
FIBER OPTIC ACCELEROMETER
R. R. AUGUST (Rockwell Intern. Corp.)
Jan. 1981
LEWIS-13219 **Vol. 5, No. 3, p. 357**
Low-cost, rugged lightweight accelerometer has been developed that converts mechanical motion into digitized optical outputs and is immune to electromagnetic and electrostatic interferences. Instrument can be placed in hostile environment, such as engine under test, and output led out through miscellany of electrical fields, high temperatures, etc., by optic fiber cables to benign environment of test panel. There, digitized optical signals can be converted to electrical signals for use in standard

electrical equipment or used directly in optical devices, such as optical digital computer.

B80-10390
HEAT/PRESSURE SEAL FOR MOVING PARTS
M. L. STEVENS (Fairchild Republic Co.)
Jan. 1981
MSC-18422 **Vol. 5, No. 3, p. 358**
Prototype seal keeps hot gases from leaking between large, adjacent parts in relative motion. Seal withstands temperatures greater than 1,000 degrees C (1800 degrees F) and accommodates heat and pressure caused distortion of parts. It is nonabrasive, creates little resistance to movement of parts, and causes minimal wear and damage to surface coatings.

B80-10391
HEAT SWITCH HAS NO MOVING PARTS
S. H. CASTLES
Jan. 1981
GSFC-12625 **Vol. 5, No. 3, p. 359**
No moving parts are needed for thermally actuated switch. It could also operate as variable thermal conductance, allowing temperature of equipment to be regulated with minimal expenditure of energy.

B80-10392
DYNAMICS OF CAVITATING CASCADES AND INDUCER PUMPS
C. E. BRENNEN (California Inst. of Tech.) and A. J. ACOSTA (California Inst. of Tech.)
Jan. 1981
M-FS-25399 **Vol. 5, No. 3, p. 359**
Report chronicles advances in understanding and predicting unsteady dynamic characteristics of cavitating cascades and inducer pumps. It includes bibliography of 19 papers authored between 1972 and 1980.

B80-10393
SIMPLIFIED THERMAL ANALYZER
M. J. COYLE
Jan. 1981
GSFC-12638 **Vol. 5, No. 3, p. 360**
Simplified Shuttle Payload Thermal Analyzer (SSPTA) aids in evaluating thermal design of instruments to be flown in Space Shuttle cargo bay. It is collection of programs that are currently used in thermal analysis of spacecraft, modified for quick, preliminary analysis of payloads. Although designed primarily to analyze Shuttle payloads, it can be easily used for thermal analysis in other situations.

B80-10394
RESIZING STRUCTURES FOR MINIMUM WEIGHT
C. FLEURY and L. A. SCHMIT (California Univ.)
Jan. 1981
LANGLEY-12699 **Vol. 5, No. 3, p. 361**
Approximation concepts and dual-method algorithms are combined in method of minimum-weight design for structures. Approximation Concepts Code for Efficient Structural Synthesis (ACCESS3) program is powerful research tool in which mathematical programming and optimality criteria are coalesced in efficient structural weight-minimization method.

B80-10395
NASTRAN MODIFICATIONS FOR RECOVERING STRAINS AND CURVATURES
C. C. CHAMIS and C. H. HENNRICH (MacNeal-Schwendler Corp.)
Jan. 1981
LEWIS-12592 **Vol. 5, No. 3, p. 361**
NASTRAN, NASA's general-purpose finite-element structural analysis program, has been modified to allow recovery of surface strains, reference plane strains, and local curvatures at nodes of general plane elements. NASTRAN routines that operate on element stress/strain/temperature relationships and strain/temperature relationships have been modified to incorporate generation and return of strains and curvatures in lieu of stresses. Strains and curvatures are then transformed to material axes and interpolated to generate corresponding strains and curvatures at nodes of element. This interpolation is accomplished using special surface-mapping function.

B80-10396
COST-MINIMIZED AIRCRAFT TRAJECTORIES
H. LEE and H. ERZBERGER
Jan. 1981
ARC-11282 **Vol. 5, No. 3, p. 361**
For aircraft operating over fixed range, operating costs are basically sum of fuel cost and time cost; but determining minimum cost trajectory can be complex. Program optimizes trajectories with respect to cost function that is based on weighed sum of fuel cost and time cost. Minimum fuel, minimum time, and various delay trajectories are obtained by specifying particular values for fuel and time cost factors.

B80-10397
AERODYNAMIC PRELIMINARY ANALYSIS
E. BONNER (Rockwell International Corp.), W. CLEVER (Rockwell International Corp.), P. DIVAN (Rockwell International Corp.), K. DUNN (Rockwell International Corp.), and J. KOJIMA (Rockwell International Corp.)
Jan. 1981
LANGLEY-12404 **Vol. 5, No. 3, p. 362**
Computerization of aerodynamic theory has progressed to state where analysis of complete aircraft configurations can be performed in single program. Aerodynamic Preliminary Analysis System, APAS, is comprehensive aerodynamic analysis system, based on linearized potential theory. Three-dimensional configurations (with or without jet flaps) having multiple nonplanar surfaces of arbitrary planform and open or closed slender bodies of noncircular contour may be analyzed with APAS. As preliminary design aid, APAS allows designer to survey systematically large number of alternative configurations and component geometries economically.

B80-10398
INVISCID TRANSONIC FLOW OVER AXISYMMETRIC BODIES
J. C. SOUTH, JR. and J. D. KELLER
Jan. 1981
LANGLEY-12499 **Vol. 5, No. 3, p. 363**
Axisymmetric transonic flow is of interest not only because of its practical application to missle and launch vehicle aerodynamics but also because of its relation, in terms of area rule, to fully three dimensional flow. RAXBOD computer program analyzes steady, inviscid, irrotational, transonic flow over axisymmetric bodies in free air. RAXBOD uses finite-difference relaxation method to solve numerically exact formulation of disturbance velocity potential with exact surface boundary conditions. Agreement with available experimental results has been good in cases where viscous effects and wind-tunnel wall interference are not important.

B80-10399
PLASTIC DEFORMATION OF ENGINES AND OTHER NONLINEAR STRUCTURES
R. G. VOS (Boeing Co.) and J. L. ARNQUIST (Boeing Co.)
Jan. 1981
M-FS-23814 **Vol. 5, No. 3, p. 363**
Plastic Analysis Capability for Engines (BOPACE3D) in nonlinear stress-analysis program based on very general family of isoparametric finite elements. Although development of BOPACE3D has been heavily influenced by requirements for engine analysis (in particular Space Shuttle main engine), it is general program applicable to many nonlinear structures.

B80-10400
ANALYSIS OF A COOLED, TURBINE BLADE OR VANE WITH AN INSERT
R. E. SAUGLER
Jan. 1981
LEWIS-13293 **Vol. 5, No. 3, p. 364**
Computer program, TACTI, has been developed to calculate transient and steady-state temperatures, pressures, and flow in cooled turbine blade or vane with impingement insert. Coolant-side

heat-transfer coefficients are calculated internally in program, with user specifying 1 of 3 modes of heat transfer at each station: impingement (including effect of crossflow); or forced convection over pin fins.

B80-10506
AN OVEN FOR MANY THERMOCOUPLE REFERENCE JUNCTIONS
L. P. LEBLANC
Apr. 1981
FRC-10112 **Vol. 5, No. 4, p. 467**
Compact, lightweight oven designed with geometric and heating symmetry holds many junctions at stable temperature. Oven has cylindrical wall with all points equidistant from heating coil. Thermocouple junctions are inserted in holes bored radially in wall. Sensor controls power supplied to heating coil, maintaining cylinder wall and junctions at constant temperature.

B80-10507
ISOLATION AND MEASUREMENT OF ROTOR VIBRATION FORCES
I. KENIGSBERG (United Technologies Corp.) and J. F. MADDEN (United Technologies Corp.)
Apr. 1981 See also A79-18654
LANGLEY-12476 **Vol. 5, No. 4, p. 468**
Mounting for helicopter gearbox measures forces generated by rotor and isolates transmission from airframe. Mountings have frequency-dependent load/displacement relationship that gives statically rigid but dynamically soft support, lowering vibratory transfer. Previous isolation by springs or force-opposing devices required strain gages to measure rotor vibration and were operative at only one vibration frequency. Active system eliminates these limitations.

B80-10508
IMPROVED LEEM RANGES OVER FOUR DECADES
J. J. SINGH, G. M. WOOD, JR., G. H. RAYBORN (University of Southern Mississippi), and F. A. WHITE (Rensselaer Polytechnic Institute)
Apr. 1981 See also NASA-TM-80172(N80-13429)
LANGLEY-12706 **Vol. 5, No. 4, p. 469**
Low-energy electron magnetometer is suitable for terrestrial and aerial applications. Electron beam strikes tantalum collector plates in device, amplifying current and converting it to frequency. Current difference increases with beam deflection, providing measure of local field strength. LEEM operation requires no liquid helium unlike superconducting quantum interference device. LEEM sensitivity compares favorably with that of optical absorption magnetometers, and microsecond response range makes analyzing fast magnetic transients and signatures possible.

B80-10509
IMAGER DISPLAYS FREE FALL IN STOP ACTION
R. E. FRAZER (Caltech)
Apr. 1981
NPO-14779 **Vol. 5, No. 4, p. 470**
Microprocessor-controlled imaging system displays sequence of 'frozen' images of free-falling object, using video cameras positioned along fall. Strobe lights flash as object passes each camera's viewfield. Sequence stored on video disk and displayed on television monitor is stop-action record of fall dynamics. With modification, system monitiors other high speed phenomena.

B80-10510
TRANSDUCER FOR EXTREME TEMPERATURES AND PRESSURES
H. NADLER (Rockwell International Corp.)
Apr. 1981
MSC-18778 **Vol. 5, No. 4, p. 471**
Transducer with limits of 500 C and 10 kilobars responds to mechanical vibrations up to 20 kHz. Vibration pickup performs well in nuclear reactors, turbines, and other extreme environments. Low pressure problems of outgassing and 'virtual' leakage experienced with conventional transducers potted in epoxy are eliminated with use of glass and metal supports. Interior opens to atmosphere, preventing buildup of pressure-induced stresses. Spring holds transducer against housing, reducing strain distortion.

B80-10511
BULK LIFETIME INDICATES SURFACE CONTAMINATION
P. D. BLAIS (Westinghouse Electric Corp.)
Apr. 1981
NPO-14966 **Vol. 5, No. 4, p. 471**
Indirect measurement of wafer surface impurities has sensitivity of 300 monolayers. Photoconductivity-decay apparatus determines bulk recombination lifetime in semiconductor materials. Bulk impurity levels before and after annealing relate to level of surface contamination. Method evaluates wafer cleaning techniques, qualifying purity of chemical and deionized water used, or monitors production process.

***B80-10512**
BIAXIAL METHOD FOR IN-PLANE SHEAR TESTING
H. G. BUSH and T. WELLER (National Academy of Sciences)
Apr. 1981 See also NASA-TM-74070(N78-21489)
LANGLEY-12680 **Vol. 5, No. 4, p. 472**
Method for obtaining uniform shear deformation yields more accurate values for material mechanical properties than uniaxial picture frame techniques. Forces applied are one-half usual magnitude, reducing transmitted force and related pin deformations. Biaxial method installs square sandwich specimen in stiff frame with pinned corners. Frictional effects are negligible, and stiffening of honeycomb core is corrected for in results.

B80-10513
GAS ABSORPTION/DESORPTION TEMPERATURE-DIFFERENTIAL ENGINE
C. G. MILLER (Caltech)
Apr. 1981
NPO-14528 **Vol. 5, No. 4, p. 474**
Continuously operating compressor system converts 90 percent of gas-turbine plant energy to electricity. Conventional plants work in batch mode, operating at 40 percent efficiency. Compressor uses metal hydride matrix on outside of rotating drum to generate working gas, hydrogen. Rolling valve seals allow continuous work. During operation, gas is absorbed, releasing heat, and desorbed with heat gain. System conserves nuclear and fossil fuels, reducing powerplant capital and operating costs.

B80-10514
INSTRUMENT MEASURES CLOUD COVER
E. G. LAUE (Caltech)
Apr. 1981
NPO-14936 **Vol. 5, No. 4, p. 474**
Eight solar sensing cells comprise inexpensive monitoring instrument. Four cells always track Sun while other four face sky and clouds. On overcast day, cloud-irradiance sensors generate as much short-circuit current as Sun sensor cells. As clouds disappear, output of cloud sensors decreases. Ratio of two sensor type outputs determines fractional cloud cover.

B80-10515
COMPACT INFRARED DETECTOR
A. GUPTA (Caltech), S. HONG (Caltech), and J. MOACANIN (Caltech)
Apr. 1981
NPO-14864 **Vol. 5, No. 4, p. 475**
Broadband IR detector integrated into compact package for pollution monitoring and weather prediction is small, highly responsive, and immune to high noise. Sensing material is transparent sheet metalized with reflecting coating and overcoated with black material on same side. Pulse produced by chopping of infrared source beam creates transient 'thermal lens' that temporarily defocuses laser beam probe. Detector monitoring beam measures defocusing which parallels infrared intensity.

B80-10516
FAST CALIBRATION OF GAS FLOWMETERS
R. V. LISLE and T. L. WILSON
Apr. 1981
KSC-11076 **Vol. 5, No. 4, p. 476**

Digital unit automates calibration sequence using calculator IC and programmable read-only memory to solve calibration equations. Infrared sensors start and stop calibration sequence. Instrument calibrates mass flowmeters or rotameters where flow measurement is based on mass or volume. This automatic control reduces operator time by 80 percent. Solid-state components are very reliable, and digital character allows system accuracy to be determined primarily by accuracy of transducers.

B80-10517
WIND-SIMULATION TESTER FOR SOLAR MODULES
J. S. GRIFFITH (Caltech)
Apr. 1981
NPO-14837 **Vol. 5, No. 4, p. 477**
Tester induces cyclic pressure loads across module surface, guaranteeing its mechanical integrity. Module to be tested is sandwiched between stiffened aluminum layers covered with rubber sheets. Automatic front and back pressure loading is cycled by pneumatic system on separate stand. Relief valves prevent overpressuring. Fixture operates at high speed, completing cycle in 5 seconds, and typically applies 2,400 pascals.

B80-10518
HEAT PIPES COOL PROBE AND SANDWICH PANEL
C. J. CAMARDA, L. M. COUCH, and H. N. KELLY
Apr. 1981
LANGLEY-12637 **Vol. 5, No. 4, p. 478**
Two concepts integrate heat-pipe technology. Probe with heat-pipe cooled jacket is self-contained, passive, and has no moving parts, unlike conventional air and water cooled probes. It is used in hostile, high temperature environments like wind tunnels and powerplants or on high-speed research and hypersonic cruise vehicles. Heat-pipe sandwich panel combines structural efficiency of sandwich with thermal efficiency of heat-pipe. It is used to eliminate thermal gradients and stresses, minimize thermal distortions, and transfer heat from one face of panel to other.

B80-10519
THERMODYNAMIC AND TRANSPORT PROPERTIES OF AIR/WATER MIXTURES
T. E. FESSLER
Apr. 1981
LEWIS-13432 **Vol. 5, No. 4, p. 479**
Subroutine WETAIR calculates properties at nearly 1,500 K and 4,500 atmospheres. Necessary inputs are assigned values of combinations of density, pressure, temperature, and entropy. Interpolation of property tables obtains dry air and water (steam) properties, and simple mixing laws calculate properties of air/water mixture. WETAIR is used to test gas turbine engines and components operating in relatively humid air. Program is written in SFTRAN and FORTRAN.

B80-10520
CALCULATING LINEAR A, B, C, AND D MATRICES FROM A NONLINEAR DYNAMIC ENGINE SIMULATION
L. C. GEYSER
Apr. 1981
LEWIS-13250 **Vol. 5, No. 4, p. 479**
Digital program DYGABCD generates linear state-space models for simulating turbofan and turbojet engines over complete range of power settings and flight conditions. Program is written in FORTRAN IV for batch execution and is implemented on IBM 360-series computer.

B80-10521
STRUCTURAL DESIGN WITH STRESS AND DISPLACEMENT CONSTRAINTS
J. KIUSALAAS (Pennsylvania State University) and G. B. REDDY (Pennsylvania State University)
Apr. 1981
M-FS-25235 **Vol. 5, No. 4, p. 480**
DESAPI program synthesizes linear elastic structures under static loads. Its design objective is finding element sizes that minimize total weight without changing layout structure. Primary constraints are upper limits on stresses and displacements prescribed as yield and local instability criteria. Program is written in FORTRAN IV for batch execution and is implemented on IBM 360 computer.

B80-10522
AN ALL-FORTRAN VERSION OF NASTRAN FOR THE VAX
L. PURVES
Apr. 1981
GSFC-12600 **Vol. 5, No. 4, p. 481**
All FORTRAN version of NASA structural analysis program NASATRAN is implemented on DEC VAX-series computer. Applications of NASATRAN extend to almost every type of linear structure and construction. Two special features are available in VAX version; program is executed from terminal in manner permitting use of VAX interactive debugger, and links are interactively restarted when desired by first making copy of all NASATRAN work files.

B80-10523
POTENTIAL FLOW IN TWO-DIMENSIONAL DEFLECTED NOZZLES
J. D. HAWK and N. O. STOCKMAN
Apr. 1981
LEWIS-13461 **Vo. 5, No. 4, p. 481**
Three programs analyze flow: SCIRCL, geometry definition program; 24Y, incompressible two-dimensional potential-flow program; and NOZZLEC, program combining incompressible potential-flow solutions into solutions of interest after compressibility correction. Program group is written in FORTRAN IV for implementation on UNIVAC 1100/42.

B80-10524
THE DESIGN AND ANALYSIS OF LOW-SPEED AIRFOILS
R. EPPLER (University of Stuttgart) and D. M. SOMERS
Apr. 1981
LANGLEY-12727 **Vol. 5, No. 4, p. 481**
PROFILE program solves diverse and inverse airfoil-flow problems. It combines conformational mapping method for design of airfoils with prescribed velocity-distribution characteristics, panel method for potential-flow analysis, and boundary-layer method. PROFILE is written in FORTRAN IV for implementation on CDC 6000-series computer.

B80-10525
TRANSONIC FLOW OVER WING/FUSELAGE CONFIGURATIONS
C. W. BOPPE (Grumman Aerospace Corp.)
Apr. 1981
LANGLEY-12702 **Vol. 5, No. 4, p. 482**
Wing Body Code (WIBCO) program simulates flow-field configurations for reduction of design cost and improvement of aircraft performance. Inputs to WIBCO consist of ambient flow conditions and geometric configuration data; grid control and relaxation parameters are internally set. Outputs include input data echo, grid system verification, relaxation-solution convergence history, and computed velocities, pressures, forces, moments, reference lengths, and areas. Program is written in FORTRAN IV for batch execution.

07 MACHINERY

B80-10093
PRECISION FILAMENT CUTTER
A. D. MCHATTON, A. L. NEWCOMB, JR., and G. SCHLUFE (Bionetics Corp.)
Aug. 1980
LANGLEY-12564 **Vol. 5, No. 1, p. 79**
Automated cutter precisely chops filaments of glass, graphite, plastic, and other materials into fibers for use in composites and other applications. Cutter uses movable blade that is pushed

and pulled across fixed blade. Because mass of movable blade is small and stroke is short, operation is fast, and wear and energy consumption are low. Blade cuts on both forward and return movements. Operator selects fiber length and chopping rate. After each cut, blast of air blows filament away so it can be collected.

B80-10094
AUTOMATIC CONNECTOR FOR STRUCTURAL BEAMS
G. F. VON TIESSEHAUSEN
Aug. 1980
M-FS-25134 **Vol. 5, No. 1, p. 80**
Lightweight connector automatically aligns beams to be jointed, and withstands torsion, tension, and compression loads. One beam has connector, other has receptor. Bracket aligns connector and receptor. When actuated, spring in connector pushes shaft into receptor. Hooks on shaft snap to lock into receptor slots. Union can be separated easily without damage. Connectors are designed for in-space assembly, but may be suited to ground assemblies as well.

B80-10095
MECHANICAL END JOINT FOR STRUCTURAL COLUMNS
H. G. BUSH and R. E. WALLSOM (Vought Corp.)
Aug. 1980
LANGLEY-12482 **Vol. 5, No. 1, p. 81**
Connector for tubular struts permits construction of lightweight frames without tools or assembly equipment. Two main components are node fitting and strut element. Components are aleaned approximately and pushed together. Design accommodates reasonable axial and rotational misalignment of nodes and struts. Also, individual columns can be inserted into receptacle and given slight push by operator, trigger pins release ratchet, allowing energy stored in springs to rotate screw into nut in receptacle.

B80-10096
SELF-ENERGIZED SCREW COUPLING
A. E. LEFEVER (Rockwell International Corp.) and R. S. TOTAH (Rockwell International Corp.)
Aug. 1980
M-FS-25340 **Vol. 5, No. 1, p. 82**
Threaded coupling carries its own store of rotational energy. Originally developed to ease task of astronauts assembling structures in space, coupling offers same advantages in other hazardous operations, such as underwater and in and around nuclear reactors. Coupling consists of two parts: crew portion and receptacle. When screw portion is inserted into receptacle and given slight push by operator, trigger pins release ratchet, allowing energy stored in springs to rotate screw into nut in receptacle.

B80-10097
AUTOMATIC SHUTOFF VALVE
S. F. HAWKINS (Rockwell International Corp.) and C. W. OVERBEY (Rockwell International Corp.)
Aug. 1980
MSC-19385 **Vol. 5, No. 1, p. 8**
Cellulose-sponge disk absorbs incoming water and expands with enough force to shut valve. When water recedes, valve opens by squeezing sponge dry to its original size. This direct mechanical action is considered more reliable than solenoid valve.

B80-10098
VISE HOLDS SPECIMENS FOR MICROSCOPE
W. N. GREULE (Rockwell International Corp.)
Aug. 1980
MSC-18690 **Vol. 5, No. 1, p. 83**
Convenient, miniature, spring-loaded clamp holds specimens for scanning electron microscope. Clamp is made out of nesting sections of studded angle-aluminum. Specimens are easier to mount and dismount with vise than with conductive adhesive or paint.

B80-10099
TUBING CUTTER FOR TIGHT SPACES
A. S. GIRALA
Aug. 1980
MSC-18538 **Vol. 5, No. 1, p. 84**
Cutter requires few short swings of handle to rotate its cutting edge full 360 around tube. It will cut tubing installed in confined space that prevents free movement of conventional cutter. Cutter is snapped onto tube and held in place by spring-loaded clamp. Screw ratchet advances cutting wheel.

B80-10100
ALUMINUM-ENCASED LEAD MALLET
F. CHIN (Rockwell, International Corp.) and I. F. PARDUE (Rockwell International Corp.)
Aug. 1980
MSC-18529 **Vol. 5, No. 1, p. 85**
Soft hammer will not mar or distort work piece. Aluminum casing, made from aluminum tube, reduces flaring and flaking of lead. Lead can be melted out and recast to refurbish hammer when necessary. Hammer would replace plastic, lead, and aluminum soft hammers currently used widely in industry.

B80-10101
CLAMSHELL DOOR SYSTEM
D. R. HELBLE (Rockwell International Corp.)
Aug. 1980
MSC-18468 **Vol. 5, No. 1, p. 85**
Space shuttle system opens, closes, and latches bay doors. System includes remotely controlled 'zipper latch' that accommodates misalignment. Opening, closing, and latching follow specific sequences, and are monitored from cockpit. Entire system could be modified for commercial jetliners and marine vessels with underwater access doors.

B80-10102
MEASURING BALL-BEARING LOADS
M. F. BUTNER (Rockwell International Corp.)
Aug. 1980
M-FS-19505 **Vol. 5, No. 1, p. 86**
Contour of wear-path boundary in bearing race gives precise information about magnitude, direction and imbalance of load. Simple tool measures height of path perimeter as bearing race is rotated manually on flat surface.

B80-10103
RETAINING A SLEEVE ON A SHAFT
R. PESSIN (Rockwell International Corp.)
Aug. 1980
M-FS-19518 **Vol. 5, No. 1, p. 87**
Snap ring with slotted tabs fits groove in shaft. Sleeve to be held on shaft fits over snap ring keeping it from expanding. Tabs are bent out to keep sleeve from slipping off shaft.

B80-10104
COMPACT POSITIONING FLANGE
S. L. HOOPER (Kentron Hawaii, Ltd.)
Aug. 1980
MSC-14876 **Vol. 5, No.1, p 88**
Flange adjusts center of rotation of gimble-mounted objects such as telescopes. Three aluminum plates are machined to have interlocking orthogonal keys and ways. Outer plate is mounted to shaft. Inner plate is attached to object. Middle and inner plate slide along on axis. Screws slide in slots parallel to ways for adjustment, then tighten to lock position along each axis. Device is similar to crossed ways found on industrial machine tools, but simpler, lighter, and much smaller.

B80-10105
BOLT-TENSION INDICATOR
K. L. WILSON (Rockwell International Corp.)
Aug. 1980
M-FS-19324 **Vol. 5, No. 1, p. 88**
Pin attached to bottom of hole through long axis of machine bolt can be used to indicate correct bolt tension without torque meters or extensometers. Bolt elongates when tightened, but pin does not, and so appears to recede within bolt head. Steps cut in exposed end of pin would indicate acceptable range of

tightness. Design would be particularly convenient in field locations without specialized instrumentation.

B80-10106
DUAL MODE ACTUATOR
S. C. RICK
Aug. 1980
LANGLEY-12412 **Vol. 5, No. 1, p. 89**

Compact mechanism functions under automatic control, manual control, or both. Output shaft rotation is controlled automatically by two hydraulic cylinders or manually by movement of input lever. Automatic control movement is isolated from manual-control movement by adjustment of force on piston spring. Actuator can be modified to control straight line position rather than rotation, or to open valves that regulate fluid flow in actuator, thus creating special movements other than simple rotation.

B80-10107
ZERO-TORQUE SPANNER WRENCH
M. V. FRIEDELL (Martin Marietta Corp.)
Aug. 1980
MSC-14843 **Vol. 5, No. 1, p. 90**

Wrench converts gripping action of hand to rotary motion without imparting reactive moments or forces on part being turned or on operator. Wrench should be useful in undersea operations and other delicate work where reactive forces and torques have to be controlled. In design for valve tightening, tool resembles cross between conventional spanner wrench and pilers. One handle engages valve body; second handle has ratchet pawl that engages toothed coupling ring on perimeter of valve handle. When operator squeezes wrench handles, valve handle rotates with respect to valve body.

B80-10108
DRILL-MOTOR HOLDING FIXTURE
E. N. CHARTIER (Rockwell International Corp.) and L. N. CULP (Rockwell International Corp.)
Aug. 1980
MSC-18582 **Vol. 5, No. 1, p. 91**

Guide improves accuracy and reduces likelihood of bit breakage in drilling large work pieces. Drill motor is mounted on pipe that slides on furniture clamp. Drill is driven into work piece by turning furniture-clamp handle.

B80-10109
SELF-ACTING SHAFT SEALS
L. P. LUDWIG
Aug. 1980
LEWIS-13229 **Vol. 5, No. 1, p. 92**

Report reviews operating principles and design of self-acting seals. Influences of adverse operating conditions are considered also. Elements of analysis used in seal performance predictions are described and evaluated. Mathematical models for obtaining seal force balance and equilibrium film thickness are outlined. Self-acting seals are nonrubbing, have lower leakage rates than labyrinth seals, and are well suited for advanced aircraft engines.

B80-10240
FLARED TUBE ATTACHMENT FITTING
I. D. ALKIRE (Rockwell Intern. Corp.) and J. P. KING, JR. (Rockwell Intern. Corp.)
Sep. 1980
MSC-18416 **Vol. 5, No. 2, p. 213**

Tubes can be flared first, then attached to valves and other flow line components, with new fitting that can be disassembled and reused. Installed fitting can be disassembled so parts can be inspected. It can be salvaged and reused without damaging flared tube; tube can be coated, tempered, or otherwise treated after it has been flared, rather than before, as was previously required. Fitting consists of threaded male portion with conical seating surface, hexagonal nut with hole larger than other diameter of flared end of tube, and split ferrule.

B80-10241
TUBE FLARE INSPECTION TOOL
G. E. MEUNIER (Rockwell Intern. Corp.)
Sep. 1980
MSC-19636 **Vol. 5, No. 2, p. 213**

Flare angle and symmetry of tube ends can be checked by simple tool that consists of two stainless steel pins bonded to rubber plug. Primary function of tool is to inspect tubes before they are installed, thereby eliminating expense and inconvenience of repairing leaks caused by imperfect flares. Measuring hole tapers, countersink angles, and bearing race angles are other possible uses. Tool is used with optical comparator. Axis of tool is alined with centerline of tube. Shadow of seated pins on comparator screen allows operator to verify flare angle is within tolerance.

B80-10242
A VERSATILE TUNNEL ACTS AS A FLEXIBLE DUCT
N. D. BROWN (Goodyear Aerospace Corp.), N. C. COSTAKOS (Goodyear Aerospace Corp.), and G. L. JEPPESEN (Goodyear Aerospace Corp.)
Sep. 1980
M-FS-22636 **Vol. 5, No. 2, p. 214**

Tunnel activated by cable assembly can be expanded, contracted, and bent similar to flexible duct without uncoupling at either end. Tunnel was developed to join reusable space vehicle with cargo module and could be modified to be used as hydraulic or pneumatic hose or duct connecting complex moveable joints in remote manipulators and earth moving machinery.

B80-10243
MECHANICAL HAND FOR GRIPPING OBJECTS
K. H. CLARK and J. D. JOHNSTON
Sep. 1980
M-FS-23692 **Vol. 5, No. 2, p. 215**

End effector serves as 'hand' for remote manipulator spacecraft system to grasp objects of various sizes. Device has built in flexible wrist joint 'cartilage' for increased gripping force without significant strain on mechanical connections.

B80-10244
HIGH-PERFORMANCE, MULTIROLLER TRACTION DRIVE
S. LOWENTHAL, D. A. ROHN, E. ZARETSKY, N. E. ANDERSON (U.S. Army Research & Technology Lab.), and A. NASVYTIS (Transmission Research, Inc.)
Sep. 1980 See also NASA-TP-1378(N79-13369)
LEWIS-13347 **Vol. 5, No. 2, p. 216**

Fixed-speed-ratio traction drive (NASVYTRAC) has been developed that can transmit high power across large speed ratio using compact cluster of rollers. Traction drive transmits power without gear teeth, through shear forces on thin lubricant film that separates drive rollers. Automatic loading mechanism regulates normal load between rollers so sufficient normal load is present to transmit required torque without slip or overloading.

B80-10245
LOCKNUT PRELOAD TOOL
J. E. GREENWOOD (Rockwell Intern. Corp.) and J. F. KAUPPI (Rockwell Intern. Corp.)
Sep. 1980
MSC-16153 **Vol. 5, No. 2, p. 217**

Small tool replaces large torque wrench for turning locknuts. Preload tool 'stretches' threaded rod on which locknut turns, reducing force on nut which can then be turned by common hand wrench. Advantages are reduced cost and weight, ease of manipulation in cramped space near actuators, and portability.

B80-10246
SELF-ADJUSTING MECHANICAL SNUBBING LINK
E. V. HOLMAN (Rockwell Intern. Corp.)
Sep. 1980
MSC-16134 **Vol. 5, No. 2, p. 218**

All-mechanical shock-absorber concept has several advantages over hydraulic devices. Snubbing link automatically adjusts length under light loads, locks at any position when onslaught exceeds design limits for which it is set, and will not leak oil or require periodic servicing. Concept can be incorporated as safety device on material handling systems or as energy absorption device or governor for machines or equipment.

B80-10247
BAYONET PLUG WITH RAMP-ACTIVATED LOCK
K. E. WOOD (Rockwell Intern. Corp.)
Sep. 1980
MSC-18526 **Vol. 5, No. 2, p. 218**

Matched pair of washers with broad surface ramps is locking mechanism in bayonet plug. It can be used where threaded springs and fasteners are impractical because of extreme temperatures or other environmental incompatibility. Matched pair of ramped washers is placed on plug and bayonet inserted. Inner slot of one washer matches contour of plug; this washer is stationary. Inner slot of second washer is circular. When second washer is rotated, washers push against bayonet plug, locking it in place. Retaining wire secures plug.

B80-10248
HEAT-PIPE SENSOR FOR REMOTE LEVELING
J. P. MARSHBURN
Sep. 1980
GSFC-12095 **Vol. 5, No. 2, p. 219**

System gives level readings in inaccessible areas. Level sensor is equipped with three thermocouples used to measure temperature differences that arise when pipe is tilted. When platform on which pipe is resting is level, three thermocouple recordings are identical. When readings are unequal, platform is leveled by remote control. System can replace expensive optical equipment and can function in cold, vacuum, and hot humid environments that produce nonlinear expansion and contraction in conventional equipment. Other advantages include low cost, no moving parts, and operation in toxic environments.

B80-10249
AUTOMATIC 35 MM SLIDE DUPLICATOR
H. F. SEIDEL and R. E. TEXLER
Sep. 1980
LEWIS-13399 **Vol. 5, No. 2, p. 220**

Automatic duplicator is readily assembled from conventional, inexpensive equipment and parts. Series of slides can be exposed without operator attention, eliminating considerable manual handling and processing ordinarily required. At end of programmed exposure sequence, unit shuts off and audible alarm signals completion of process.

B80-10250
THE 3-D GUIDANCE SYSTEM WITH PROXIMITY SENSORS
A. K. BEJCZY (Caltech)
Sep. 1980
NPO-14521 **Vol. 5, No. 2, p. 221**

Four proximity sensors help to guide mechanical claw into alinement with target fixture. Digital signals are used to sense distance and to aline roll, pitch, and yaw with respect to target before it is grasped. Sixteen sensor-to-operator messages are possible with binary signal system. Similar, more precise alternative presents 75 workable logic states; most precise alternative uses continuous calibrated data from sensors.

B80-10251
AUTOMATIC CONNECTOR JOINS STRUCTURAL COLUMNS
G. G. JACQUEMIN (Lockheed Missiles & Space Co., Inc.)
Sep. 1980
LANGLEY-12578 **Vol. 5, No. 2, p. 222**

Connector snap-locks over toothed bolthead mounted on column end, forming rigid joint that will not bend or twist. Connector is used in conventional construction to install temporary structures or as mechanical coupler. Up to nine receptacles can be clustered in one node to join up to nine converging columns.

B80-10252
TEST FITTINGS FOR DIMENSIONALLY CRITICAL TUBES
R. HAGLER (Caltech)
Sep. 1980
NPO-14399 **Vol. 5, No. 2, p. 222**

Method using lightweight fitting protects tubes and tube stubs during testing and through to final welding. Fitting does not interfere with final welding or brazing like temporary test fittings, and is not heavy like machined-on integral fittings with face-seal O-rings. Fitting approach is adaptable to many types of components, including valves, transducers, and filters.

B80-10253
ELECTROMECHANICAL SLIP SENSOR
A. K. BEJCZY (Caltech) and S. PARK (Caltech)
Sep. 1980
NPO-14654 **Vol. 5, No. 2, p. 223**

Sensor indicates direction of slip and slip rate of objects handled by remote manipulators. Freely movable spheroid with staggered pattern of surface indentations rotates in direction of slipping body, tilting shaft with conductive disk plate. Plate assembly is bent toward contact corresponding to direction of slip and is flicked by indentations at rate corresponding to slip rate. Slip direction and rate are determined using LED's arranged circularly or microcomputer with CRT display.

B80-10254
X-RAY BEAM POINTER
C. W. NELSON (Beech Aircraft Co.)
Sep. 1980
MSC-18590 **Vol. 5, No. 2, p. 224**

Inexpensive, readily assembled pointer aims X-ray machine for welded assembly radiographs. Plumb bob used for vertical alinement and yardstick used to visualize X-ray paths were inconvenient and inaccurate. Pointer cuts alinement time by one-half and eliminates necessity of retakes. For 3,000 weld radiographs, pointer will save 300 worker-hours and significant materials costs.

B80-10255
HANDTOOL ASSISTS IN BUNDLING CABLES
E. J. STRINGER (Rockwell Intern. Corp.)
Sep. 1980
MSC-18567 **Vol. 5, No. 2, p. 225**

Simple tool makes it possible to bundle electrical cables in channel or 'tray' without requiring cables be lifted out. Procedure for bundling is faster and less awkward than lifting method. Used with commercially-available plastic ribbons that tie cables together, tool guides ribbon along tray wall, through bracket at bottom of tray, and up opposite wall. One end of ribbon locks in other end, securing cable bundle.

B80-10256
SLEEVE PULLER SALVAGES WELDED TUBES
J. F. WEAVER (Rockwell Intern. Corp.)
Sep. 1980
MSC-18686 **Vol. 5, No. 2, p. 225**

Tool removes sleeve remnants without distorting or damaging tubes, unlike pliers and other conventional handtools. Tubes can be reused, saving time, labor, and material in many applications. Sleeve-removal fixture consists of pressure screw, swing arm, locking screws, and base. It removes sleeve remnant from tubing after welded joint has been sawed through.

B80-10257
A LINEAR MAGNETIC MOTOR AND GENERATOR
P. A. STUDER
Sep. 1980
GSFC-12518 **Vol. 5, No. 2, p. 226**

In linear magnetic motor and generator suitable for remote and hostile environments, magnetic forces drive reciprocating shaft along its axis. Actuator shaft is located in center of cylindrical body and may be supported by either contacting or noncontacting bearings. When device operates as bidirectional motor, drive coil selectively adds and subtracts magnetic flux to and from flux paths, producing forces that drive actuator along axis. When actuator is driven by external reciprocating engine, device becomes ac generator.

B80-10258
CRYOGENIC-STORAGE-TANK SUPPORT
G. H. WISDOM (McDonnell Douglas Corp.)
Sep. 1980

MSC-14848 **Vol. 5, No. 2, p. 227**

Support isolates tank from thermal and mechanical loading by environment. Design uses combination of well-known common mechanisms to isolate tank and allow for tank expansion and contraction due to temperature and pressure changes. Similar support method is used on nitrogen tanks.

B80-10259
ROTOR TRANSIENT ANALYSIS
P. E. ALLAIRE (Virginia Univ.), K. C. CHOY (Virginia Univ.), and E. J. GUNTER (Virginia Univ.)
Sep. 1980
LEWIS-13230 **Vol. 5, No. 2, p. 228**

Undamped modes approximate dynamic behavior of rotors and bearings. Application of modal analysis to uncouple equations of motion simplifies stability, steady-state unbalance response, and transient response analysis of system; nonlinear stability is predicted from calculated frequency spectra. Analysis provides designers with complete information without involving large-scale computational costs. Programs are written in FORTRAN IV for use on CDC 6600 computer.

B80-10401
CLEAVING MACHINE FOR HARD CRYSTALS
J. S. J. BENEDICTO and F. HALLBERG
Jan. 1981
GSFC-12584 **Vol. 5, No. 3, p. 367**

Hard crystalline materials such as lithium fluoride (LiF) are cleaved in thin sections by semiautomatic machine. Yield of undistorted LiF crystals is almost 100 percent, even when cleaved section is only 1/32 inch thick. Machine contains spring-activated hammer that limits penetration of blade and controls shock that cleaves crystal. Fixture with spring-loaded clamps precisely locates and holds crystal, restraining it in ideal position for cleaving. Crystal then splays apart.

B80-10402
ABRASIVE DRILL FOR RESILIENT MATERIALS
A. J. KOCH
Jan. 1981
LEWIS-13411 **Vol. 5, No. 3, p. 368**

Resilient materials normally present problem in obtaining accurate and uniform hole size and position. Tool is fabricated from stiff metal rod such as tungsten or carbon steel that has diameter slightly smaller than required hole. Piercing/centering point is ground on one end of rod. Rod is then plasma-sprayed (flame-sprayed) with suitable hard abrasive coating. High-speed, slow-feed operation of tool is necessary for accurate holes, and this can be done with drill press, hard drill, or similar machines.

B80-10403
DRILLING AT RIGHT ANGLES IN BLIND HOLES
R. PESSIN (Rockwell International Corp.)
Jan. 1981
M-FS-19535 **Vol. 5, No. 3, p. 369**

Tool drills small hole perpendicular to and at bottom of blind hole. It consists of carbide cutter brazed to flexible shaft, inside thin metal tube with 90 degree bend. Wood dowel holds tube while motor turns shaft and drives cutter. It was developed for clearing plugged fuel orifices. Concept is adaptable to other hard-to-reach drilling situations.

B80-10404
SOLAR-POWERED AIRCRAFT
W. H. PHILLIPS
Jan. 1981
LANGLEY-12615 **Vol. 5, No. 3, p. 369**

Solar-powered aircraft, driven by electric motor, has vertical and horizontal wings. Design allows aircraft to fly straight path while banked, permitting optimal exposure of its wing-mounted solar cells to Sun. Such aircraft would fly at altitude high enough to be above clouds and to avoid winds with velocities much greater than its own airspeed. Its most likely application would be as pilotless aircraft to take advantage of its ability to remain aloft for long periods (for very long flights).

B80-10405
BALL-JOINT GROUNDING RING
P. J. A. APERLO (Rockwell International Corp), P. A. BUCK (Rockwell International Corp.), and V. A. WELDON (Rockwell International Corp.)
Jan. 1981
MSC-18824 **Vol. 5, No. 3, p. 371**

In ball and socket joint where electrical insulator such as polytetrafluoroethylene is used as line to minimize friction, good electrical contact across joint may be needed for lightning protection or to prevent static-charge build-up. Electrical contact is maintained by ring of spring-loaded fingers mounted in socket. It may be useful in industry for cranes, trailers, and other applications requiring ball and socket joint.

B80-10406
VERSATILE MODULAR SCAFFOLDS
J. KERLEY
Jan. 1981
GSFC-12606 **Vol. 5, No. 3, p. 372**

Movable and fixed modular scaffolds can be tailored to most scaffolding needs by interconnecting only 4 basic structural elements: platforms, rails, vertical-support angles, and stiffener. Standard nuts and bolts are used to join elements, simplifying construction, and reducing costs. Scaffolds are rigid and can be made any length. They are stable on unlevel ground and can extend to well over 50 feet in height. Scaffolds allow for internal elevators and for wheels and air mounts so that same elements can be used for standing or movable scaffold.

B80-10407
RESHAPING TUBE ENDS FOR WELDING
W. H. EMANUEL (McDonnell Douglas Corp.) and C. A. HEADLEY (McDonnell Douglas Corp.)
Jan. 1981
MSC-18462 **Vol. 5, No. 3, p. 373**

Tube ends are rounded in preparation for welding by new semiautomatic tool. Tubes that have been trimmed close to bend may be deformed by process. To restore roundness, out-of-round tube is opened, plug inserted, and crimper compresses tube into proper shape around plug.

B80-10408
REMOTE MANIPULATOR WITH FORCE FEED-BACK
J. W. HILL (SRI International) and J. K. SALISBURY, JR. (SRI International)
Jan. 1981
ARC-11272 **Vol. 5, No. 3, p. 373**

Controller for remote manipulators gives user 'feel' for forces required to lift, slide, turn, and otherwise handle objects. Because operator experiences sensations similar to those he would perceive if he handled objects directly, he needs much less skill and training for manipulator than for one with force feedback. It was developed to handle hazardous materials, such as radioactive substances, explosives, or corrosive chemicals. Other possible uses include tracking moving objects, vehicle control, and human interaction with computers (for example, via three dimensional display of computer model).

B80-10409
SPRAYING SUSPENSIONS UNIFORMLY
W. P. PRASTHOFER
Jan. 1981
M-FS-25139 **Vol. 5, No. 3, p. 374**

With head on each of its ends, bolt can be disengaged from its blind side. Bolt has conventional hexagonal head on one end and smaller hexagonal head on its threaded end. Since reduced head is smaller than bolt diameter, it does not interfere with insertion of bolt shank in bolthole. However, it can be turned by wrench to release bolt from its blind (threaded) end. Bolt should be tethered on its large-head end so that it does not drop away from assembly.

B80-10410
TWO-HEADED BOLT
G. W. JEFFERS (Rockwell Intern. Corp.)

Jan. 1981
M-FS-19619 **Vol. 5, No. 3, p. 375**
Coarse, multi-ingredient suspensions are sprayed on surface smoothly and uniformly with aid of nozzle attachment for commercial spray gun. Nozzle attachment is contoured internally to suppress overspray and to prevent spray from segregating. From its conical inlet, nozzle converges smoothly to throat, then diverges in bell-shaped chamber that allows suspension to flow uninterruptedly without building up turbulently in nozzle. End of nozzle is adjustable and can be extended or retracted to avoid dripping when inlet pressure, pump pressure, or density of mixture changes.

B80-10411
COMPACT TABLE-TILTING MECHANISM
F. R. MITCHELL (Frank R. Mitchell and Assoc.)
Jan. 1981
NPO-14800 **Vol. 5, No. 3, p. 376**
Optical components are oriented precisely by motorized device for manipulating objects attached to plane tilt table. Mechanism is compact, simple, and has low backlash. It consists of drive motor, rotatable disk, rigid link, and table. Motor rotates about vertical axis, and motion is converted through disk and rigid link to rotation of table about perpendicular axis.

B80-10412
TIME-SHARING SWITCH FOR VACUUM BRAZING
J. A. STEIN
Jan. 1981
MSC-18699 **Vol. 5, No. 3, p. 376**
Switching unit changes power and cooling-water connections between two vacuum-brazing machines. It allows both units to be powered by single radio-frequency (RF) generator. One machine can be used for brazing while bell jar of other is being evacuated (20 minute process) in preparation for brazing or is being cooled after brazing (10 minute process).

B80-10413
LIMITING CURRENT IN ELECTRON-BEAM WELDERS
K. W. SPIEGEL
Jan. 1981
M-FS-19503 **Vol. 5, No. 3, p. 377**
Damage to workpiece by excessive current in electron-beam welder is prevented by mechanism that accurately adjusts anode-to-cathode spacing. Mechanism is installed on standard Sciaky (or equivalent) electron-beam gun with only minimal modification. By turning knurled knob and observing digital readout of anode/cathode separation, machine operator adjusts welder for safe maximum current before welding begins.

B80-10414
TORQUE-WRENCH EXTENSION
D. H. PETERSON (Rockwell International Corp.)
Jan. 1981
MSC-18769 **Vol. 5, No. 3, p. 378**
Torque-wrench extension makes it easy to install and remove fasteners that are beyond reach of typical wrenches or are located in narrow spaces that prevent full travel of wrench handle. At same time, tool reads applied torque accurately. Wrench drive system, for torques up to 125 inch-pounds, uses 2 standard drive-socket extensions in aluminum frame. Extensions are connected to bevel gear that turns another bevel gear. Gears produce 1:1 turn ratio through 90 degree translation of axis of rotation. Output bevel has short extension that is used to attach 1/4-inch drive socket.

B80-10415
QUICK MIXING OF EPOXY COMPONENTS
D. E. DUNLAP, JR. (McDonnell Douglas Corp.)
Jan. 1981
MSC-18731 **Vol. 5, No. 3, p. 379**
Two materials are mixed quickly, thoroughly, and in precise proportion by disposable cartridge. Cartridge mixes components of fast-curing epoxy resins, with no mess, just before they are used. It could also be used in industry and home for caulking, sealing, and patching. Materials to be mixed are initially isolated by cylinder wall within cartridge. Cylinder has vanes, with holes in them, at one end and handle at opposite end. When handle is pulled, grooves on shaft rotate cylinder so that vanes rotate to extrude material A uniformly into material B.

B80-10416
WRENCH FOR SMOOTH OR DAMAGED FASTENERS
R. CARRILLO (Rockwell International Corp.)
Jan. 1981
MSC-18772 **Vol. 5, No. 3, p. 380**
Smooth-surfaced or damaged fasteners that cannot be gripped by conventional wrench can be unscrewed by special wrench. It can be used in tight spaces and will not damage adjacent structures. Wrench consists of central handle and 2 independent jaws with serrated teeth. Teeth are placed on fastener to be removed, and handle is rotated until fastener is gripped with positive locking action. Rotation of wrench handle removes fastener.

B80-10526
INTERLOCKING WEDGE JOINT IS EASILY ASSEMBLED
M. J. LONG
Apr. 1981
LANGLEY-12729 **Vol. 5, No. 4, p. 485**
Wedge joint links structural members in manual, remote, or automated assemblies. Joint is simple enough to be assembled by undersea divers, workers in nuclear reactors, and other wearing gloves or bulky clothing. Combination of wedging angles on parts overcomes structural misalinements and forces assembly into true position as locking sleeve moves into place. Joint transmits tension, compression, bending moments and torsion and is inherently insensitive to thermal excursions, vibration, and machining tolerance buildup.

B80-10527
PENUMATIC-POWER SUPPLY
R. C. KRAMER (Rockwell International Corp.)
Apr. 1981
MSC-18855 **Vol. 5, No. 4, p. 486**
Portable compressed air supply has two or more outputs at pressures from 20 to 100 psi. Applications include operating production equipment, spraying paint and lubricants, and pressurizing refrigeration systems. Supply filters air from standard high-pressure line, reduces it to working pressure, and adds lubricant when required. Regulator supplies low-pressure air to output channels. On channel lines, vernier-control valves select output pressures.

B80-10528
SIDEWALL PENETRATOR FOR OIL WELLS
E. R. COLLINS, JR. (Caltech)
Apr. 1981
NPO-14306 **Vol. 5, No. 4, p. 487**
Penetrator bores horizontal holes in well casing to increase trapped oil drainage. Several penetrators operated by common drive are inserted into well at once. Shaft, made from spiraling cable, rotates and thrusts simultaneously through rigid curvilinear guide tube forcing bit through casing into strata. Device pierces more deeply than armor-piercing bullets and shaped explosive charges.

B80-10529
FOUR-WHEEL DUAL BRAKING FOR AUTOMOBILES
H. B. EDWARDS
Apr. 1981
LANGLEY-12687 **Vol. 5, No. 4, p. 488**
Each master cylinder applies braking power to all four wheels unlike conventional systems where cylinder operates only two wheels. If one master system fails because of fluid loss, other stops car by braking all four wheels although at half force.

B80-10530
LOCK FOR HYDRAULIC ACTUATORS
R. H. WOOD (Rockwell Internation Corp.)
Apr. 1981
MSC-18853 **Vol. 5, No. 4, p. 489**

Two clamps hold rod in fixed extension from cylinder even when power is off, converting actuator into stiff structural member. Locked actuator is useful as mechanical support or linkage or as fail-safe device in case of loss of hydraulic pressure. Potential applications include manufacturing processes and specialized handling and holding devices.

B80-10531
GENTLE ARRESTER FOR MOVING BODIES
R. A. HULL
Apr. 1981
LANGLEY-12372 **Vol. 5, No. 4, p. 490**
Wire cable absorbs energy at constant rate with reduced shock and rebounding. Cable typically elongates to 90 percent of its potential, but is surrounded by braided sheath to absorb remaining energy should it break prematurely. Applications of arrester include passenger restraint in air and land vehicles, parachute risers, and ground snatch by aircraft. Possible cable material is type 302 stainless steel.

B80-10532
SOFT CONTAINER FOR EXPLOSIVE NUTS
D. C. GLENN, W. E. DRUMMOND, and G. MILLER
Apr. 1981
MSC-18871 **Vol. 5, No. 4, p. 491**
Flexible fabric fits over variety of assembly shapes to contain debris produced by detonations or safety tests. Bag material is woven multifilament polyamide or aramid. Belt loops hold bag to clamp. Ring supports explosive nut structure and detonator wires, and after nut is mounted, bag and clamp are slipped over ring and fastened.

B80-10533
CYLINDRICAL BEARING ANALYSIS
R. J. KLECKNER (SKF Industries) and J. PIRVICS (SKF Industries)
Apr. 1981
LEWIS-13393 **Vol. 5, No. 4, p. 491**
Program CYBEAN computes behavior of rolling-element bearings including effects of bearing geometry, shaft misalinement, and temperature. Accurate assessment is possible for various outer-ring and housing configurations. CYBEAN is structured for coordinated execution of modules that perform specific analytical tasks. It is written in FORTRAN IV for use on the UNIVAC 1100/40 computer.

08 FABRICATION TECHNOLOGY

B80-10110
VERIFYING ROOT FUSION IN ELECTRON-BEAM WELDS
F. L. BECKER (Rockwell International Corp.), S. DOCTOR (Rockwell International Corp.), and R. E. KLEINT (Rockwell International Corp.)
Aug. 1980
M-FS-19499 **Vol. 5, No. 1, p. 95**
Ultrasonic equipment and x-y recorder indicate where back side of joint is properly welded. Wire waveguide placed in groove at root of joint to be welded is fused when joint is adequately penetrated. Ultransonic signal moving down waveguide is reflected where guide is melted. Change in reflected-signal arrival time with change in weld-head position is nearly constant unless joint is incompletely penetrated. Method permits determination of penetration depth in preweld samples without opening vacuum chamber and sectioning weld. Technique is particularly valuable when back side of joint is inaccessible.

B80-10111
X-RAY TECHNIQUE VERIFIES WELD-ROOT FUSION
R. E. KLEINT (Rockwell International Corp.)
Aug. 1980
M-FS-19468 **Vol. 5, No. 1, p. 96**
Small holes drilled along back edge of surface to be joined are filled when weld root is adequately fused. Holes 2% of thickness of material can be detected with X-rays. Absence of detectable holes indicates good weld. Procedure has been proven in production and is more reliable than conventional X-ray methods.

B80-10112
ETCHANT FOR INCOLOY-903 WELDS
J. A. GERSTMEYER (Rockwell International Corp.)
Aug. 1980
M-FS-19378 **Vol. 5, No. 1, p. 96**
Special reagent consists of 1 part 90% lactic acid, 1 part 70% nitric acid, and 4 part, 37% hydrochloric acid. Solution etches parent and weld metals at same rate, without overetching. Underlying grain structure of both metals is revealed.

B80-10113
CHEMICAL-MILLING SOLUTION FOR INVAR ALLOY
W. BATIUK (Perkin-Elmer Corp.)
Aug. 1980
M-FS-25365 **Vol. 5, No. 1, p. 97**
Excellent surface finishes and tolerances are achieved using two formulations. Solution A gives finish of 3.17 micrometers after milling at 57 to 63 deg C. Constituents of A are: Hydrofluoric acid (70%), 5.8 oz/gal; nitric acid (40-42) degrees Baume), 40 oz/gal. Alternative solution gives 2.16 micrometer finish, and differs from A by addition of 7% phosphoric acid. Formulations eliminate channeling at root fillets, dishing, island formation, and overhangs.

B80-10114
ELIMINATING UNDERBEAD FISSURING IN SUPERALLOYS
R. D. BETTS (Rockwell International Corp.)
Aug. 1980
M-FS-19460 **Vol. 5, No. 1, p. 97**
Parameters that produce high-integrity overlay welds in Incoloy-903, Incoloy-88, and Inconel-718 differ from those in conventional metal-in groove welds. Reduced weld velocity eliminates underbead crack-inducing level.

B80-10115
ION-BEAM CLEANING FOR COLD WELDS
B. L. SLATER
Aug. 1980
LEWIS-12982 **Vol. 5, No. 1, p. 98**
1000 eV beam bombarding metal surfaces to be joined removes oxides and contaminants at rate of several atomic layers per second for current density of 1 mA/squ. cm. Clean surfaces can then be joined by squeezing them together. With ion-beam cleaning, mating force for strong bond is low enough to cause only 1% deformation. Conventional cold-welding requires about 70% deformation for bonding. Technique was tested successfully on aluminum to aluminum welds, copper to copper, copper to aluminum, copper to nickel, and silver to iron. Base metals failed before welds in tear test.

B80-10116
COATINGS FOR HYBRID MICROCIRCUITS
D. L. KINSER (Vanderbilt Univ.)
Aug. 1980
M-FS-25292 **Vol. 5, No. 1 p. 99**
Silicone or parylene coatings protect circuits from damage by battery of military standard tests. PIND (Partical Impact Noise Detection) test proved unreliable in predicting failure for either coated or uncoated circuits.

B80-10117
PLACEMENT TECHNIQUE FOR SEMICUSTOM DIGITAL LSI CIRCUITS
B. CARROLL (Auburn Univ.) and G. W. COX (Auburn Univ.)
Aug. 1980
M-FS-25324 **Vol. 5, No. 1, p. 100**
Small lots of special-purpose integrated circuits are fabricated from standard transitor arrays. Folded linear order of cells minimizes interconnection length and puts cell in juxtaposition. Cell-placement technique is carried out via computer program.

B80-10118
A GENERAL LOGIC STRUCTURE FOR CUSTOM LSI'S
M. W. SIEVERS (Caltech)
Aug. 1980
NPO-14410 **Vol. 5, No. 1, p. 101**
Structure composed of standardized-circuit arrays reduces cost and complexity of fabricating special integrated circuits. Desired circuits are formed from basic mask, custom cuts, and contact points. Interactive computer program speeds design.

B80-10119
JIG FOR ASSEMBLING LARGE COMPOSITE PANELS
J. T. WATTS (McDonnell Douglas Corp.)
Aug. 1980
LANGLEY-12394 **Vol. 5, No. 1, p. 102**
Layup of composite panels as large as 15 by 60 ft is greatly facilitated by simple mechanism. Jig consists of flat, detachable table, and curved laminating-plate joined by rack and pinion to insure accurate registration. Vacuum holds thin plastic film to laminating-plate. Preimpregnated composite sheet is applied to plate, which is then lowered face down onto table. Release of vacuum leaves layer and film and table. Film is peeled off, and steps are repeated for next layer of laminate.

B80-10120
SHAPING GRAPHITE/EPOXY STIFFENERS
J. L. CUPP (Rockwell International Corp.)
Aug. 1980
MSC-18494 **Vol. 5, No. 1, p. 103**
Layers of graphite/epoxy, tape stacked on ridges and in grooves of channel like ribs stiffen curved laminates. Twenty-five to 38 layers of tape on each cap and flange are vacuum-bagged into shape and then interleaved with plies of fabric to form light-weight structural members free of wrinkles and voids. Structure could be parts for cars, trucks, and other vehicles.

B80-10121
FLUSH-MOUNTING TECHNIQUE FOR COMPOSITE BEAMS
T. C. HARMAN (United Technologies Corp.) and B. F. KAY (United Technologies Corp.)
Aug. 1980
LANGLEY-12389 **Vol. 5, No. 1, p. 104**
Procedure permits mounting of heavy parts to surface of composite beams without appreciably weakening beam web. Web is split and held apart in region where attachment is to be made by lightweight precast foam filler. Bolt hole penetrates foam rather than web, and is secured by barrelnut in transverse bushing through web.

B80-10122
EXAMINING GRAPHITE REINFORCEMENT IN COMPOSITES
R. E. SANDERS (Rockwell International Corp.) and C. I. YATES (Rockwell International Corp.)
Aug. 1980
MSC-19594 **Vol. 5, No. 1, p. 104**
Structure of graphite layers in composite parts can be checked by pyrolizing epoxy portion of composite samples. After 2-3 hours in nitrogen atmosphere at 540 C, only graphite fibers remain. These can be separated and checked for proper number, thickness, and orientation.

B80-10123
CRYOGENIC MACHINING OF POLYURETHANE FOAM
E. A. MOSHEY (RCA) and P. PRYCHKA (RCA)
Aug. 1980
MSC-18572 **Vol. 5, No. 1, p. 105**
Low-density foam can be machined precisely while frozen. Liquid nitrogen cools foam and aluminum heat sink prior to machining. Heat sink keeps part frozen during entire machining operation.

B80-10124
'GRINDING' CAVITIES IN POLYURETHANE FOAM
J. R. BROWER (Rockwell International Corp.), R. E. DAVEY (Rockwell International Corp.), W. F. DIXON (Rockwell International Corp.), P. H. ROBB (Rockwell International Corp.), and P. P. ZEBUS (Rockwell International Corp.)
Aug. 1980
MSC-18564 **Vol. 5, No. 1, p. 105**
Grinding tool installed on conventional milling machine cuts precise cavities in foam blocks. Method is well suited for prototype or midsize production runs and can be adapted to computer control for mass production. Method saves time and materials compared to bonding or hot wire techniques.

B80-10125
ALUMINA BARRIER FOR VACUUM BRAZING
C. S. BEUYUKIAN (Rockwell International Corp.)
Aug. 1980
MSC-18528 **Vol. 5, No. 1, p. 106**
Heating platens of vacuum-brazing press will not stick to workpiece if aluminum oxide 'paper' is interposed. Paper does not disintegrate in press, will not contaminate braze alloy, and helps form smoothly contoured, regular fillet at brazed edges.

B80-10126
CONNECTOR HEAT SHIELD
S. CLARKE (Wright Components, Inc.)
Aug. 1980
MSC-16282 **Vol. 5, No. 1, p. 106**
Polytetrafluoroethylene tape wrapped around electrical connectors protects them from heat damage during soldering. Tape is easily removed after contacts are joined.

B80-10127
FOAM-FILLED CUSHIONS FOR SLIDING TRAYS
S. B. NAHIN (Rockwell International Corp.) and P. H. ROBB (Rockwell International Corp.)
Aug. 1980
MSC-18565 **Vol. 5, No. 1, p. 107**
Polytetrafluoroethylene tube filled with polyurethane foam forms low friction sliding surface that cushions vibrations and absorbs manufacturing tolerances and misalignment. Possible uses include packaging of components for shipping and seals for doors in lockers, cars, and refrigerators.

B80-10128
ION-BEAM ETCHING ENHANCES ADHESIVE BONDING
B. A. BANKS, M. J. MIRTICH, and J. S. SOVEY
Aug. 1980 See also NASA-TM-79004 (N79-12909); NASA-TM-78888 (N78-24358)
LEWIS-13028 **Vol. 5, No. 1, p. 108**
Metals and fluoropolymers exposed to 0.5 to 1.0 keV argon ions at current densities of 0.2 to 1.5 mA/sq cm develop surface texturing that increases tensile and shear strength of epoxy bonds. Bonds are 46 to 100 percent stronger than those of chemically etched surfaces. Metals require 3 to 4 hours of bombardment to become properly textured. Fluoropolymers require 5 seconds to 30 minutes. Ion beam will not texture nickel. Unlike chemical treatments, bonding of fluoropolymers can be done days or months after ion treatment.

B80-10129
ROOM-TEMPERATURE ADHESIVE FOR HIGH-TEMPERATURE USE
J. L. BROOKS (Rockwell International Corp.), W. L. HILL (Rockwell International Corp.), and C. R. ROUSSEAU (Rockwell International Corp.)
Aug. 1980
MSC-16930 **Vol. 5, No. 1, p. 109**
PPQ (polyphenylquinoxaline) cures at room temperature, but withstands temperatures between -186 and +402 deg C. Adhesive is applied in chloroform solution. Bond forms as solvent evaporates.

B80-10130
EASILY-ASSEMBLED HELICAL HEATER
D. E. PIZZECK
Aug. 1980
LANGLEY-11712 **Vol. 5, No. 1, p. 110**
Rugged, compact heater is made from 0.1 mm diameter

Inconel wire (125 ohms per meter). Heating element is enclosed in PTFE heat-shrink sleeve. Ends of coal pass through small ceramic spools and are silver-brazed to lead wires. Junctions are potted in epoxy or silicon and covered with crimp sleeves and heat-shrink tubing.

B80-10131
MICROPROCESSOR SYSTEMS FOR INDUSTRIAL PROCESS CONTROL
F. H. LESH (Caltech)
Aug. 1980
NPO-14661 **Vol. 5, No. 1, p. 110**
Six computers operate synchronously and are interconnected by three independent data buses. Processors control one subsystem. Some can control buses to transfer data at 1 megabit per second. Every 2.5 msec each processor examines list of things to do during next interval. This spacecraft control system could be adapted for controlling complex industrial processes.

B80-10132
WIRE HARNESS TWISTING AID
E. J. CASEY (Rockwell International Corp.), C. C. COMMADORE (Rockwell International Corp.), and M. E. INGLES (Rockwell International Corp.)
Aug. 1980
MSC-18581 **Vol. 5, No. 1, p. 111**
Long wire bundles twist into uniform spiral harnesses with help of simple apparatus. Wires pass through spacers and through hand-held tool with hole for each wire. Ends are attached to low speed bench motor. As motor turns, operator moves hand tool away forming smooth twists in wires between motor and tool. Technique produces harnesses that generate less radio-frequency interference than do irregularly twisted cables.

B80-10133
ADJUSTABLE BASE FOR CENTERING STAKED BEARINGS
L. A. BERSON (Rockwell International Corp.)
Aug. 1980
MSC-19660 **Vol. 5, No. 1, p. 112**
Adjustable base permits housing and race to be supported separately so that unequal widths can be accounted for and bearing staked on center. If race is centered and staked on flat base and housing and race are not same width, then offset may occur and bearing will be set off center.

B80-10134
SAFELY SPLICING GLASS OPTICAL FIBERS
K. KORBELAK (General Cable Corp.)
Aug. 1980
KSC-11107 **Vol. 5, No. 1, p. 112**
Field-repair technique fuses glass fibers in flammable environment. Apparatus consists of v-groove vacuum chucks on manipulators, high-voltage dc power supply and tungsten electrodes, microscope to observe joint alignment and fusion, means of test transmission through joint. Apparatus is enclosed in gas tight bos filled with inert gas during fusion. About 2 feet of fiber end are necessary for splicing.

B80-10135
KNIFE-EDGE SEAL FOR VACUUM BAGGING
J. A. RAUSCHL (Rockwell International Corp.)
Aug. 1980
M-FS-24049 **Vol. 5, No. 1, p. 113**
Cam actuated clamps pinch bagging material between long knife edge (mounted to clamps) and high temperature rubber cushion bonded to baseplate. No adhesive, tape, or sealing groove is needed to seal edge of bagging sheet against base plate.

B80-10136
A PRECOAT PREVENTS CERAMIC STOPOFFS FROM SPALLING
A. BRENNAN (Rockwell International Corp.)
Aug. 1980
M-FS-19495 **Vol. 5, No. 1, p. 114**
Nickel-alloy precoat applied with plasmagun improves adhesion of ceramic materials applied to protect areas from unintentional brazing. Metal surface should be grit-blasted before precoating. Coating does not interfere with brazing or contaminate vacuum pumping systems.

B80-10137
SHOULD WE INDUSTRIALIZE SPACE?
G. W. DRIGGERS (Science Applications, Inc.) and C. L. GOULD (Rockwell International Corp.)
Aug. 1980
M-FS-23963 **Vol. 5, No. 1, p. 114**
Two reports project world needs over next 30 to 50 years and correlate them with space opportunities. Effects of diminishing resources, market, population, and technological changes are considered. Possible benefits are outlined.

B80-10138
COST MODELS AND ECONOMICAL PACKAGING OF LSI'S
R. P. HIMMEL (Hughes Aircraft Co.), R. G. RAVETTI, C. W. ROTHROCK, S. M. STUHLBARG, and P. J. ZULUETA
Aug. 1980
M-FS-25359 **Vol. 5, No. 1, p. 115**
Report discusses mathematical models used to estimate costs of developing and fabricating microcircuits. Second part discusses LSI packaging using tape chip carrier technology.

B80-10139
AUTOMATED ION IMPLANTATION FOR IC'S
B. W. KENNEDY
Aug. 1980
M-FS-25193 **Vol. 5, No. 1, p. 115**
Report discusses automated ion-implantation facility under development at Marshall Space Flight Center. Facility will produce ultra-reliable IC's with minimal human intervention.

B80-10140
AN AUTOMATED PHOTOLITHOGRAPHY FACILITY FOR IC'S
B. W. KENNEDY
Aug. 1980
M-FS-25073 **Vol. 5, No. 1, p. 116**
Report discusses subsystems that will constitute fully-automated photolithography facility for IC's. Facility being developed at Marshall Space Flight Center will produce ultrareliable IC's with minimal human intervention.

B80-10141
MODELS OF MOS AND SOS DEVICES
J. D. GASSAWAY (Mississippi State Univ.), Q. MAHMOOD (Mississippi State Univ.), and J. D. TROTTER (Mississippi State Univ.)
Aug. 1980
M-FS-25153 **Vol. 5, No. 1, p. 116**
Quarterly report describes progress in three programs: dc sputtering machine for aluminum and aluminum alloys; two dimensional computer modeling of MOS transistors; and development of computer techniques for calculating redistribution diffusion of dopants in silicon on sapphire films.

B80-10260
PHOTONITRIDE PASSIVATING COATING FOR IC'S
T. C. HALL and J. W. PETERS
Sep. 1980
M-FS-25401 **Vol. 5, No. 2, p. 231**
Increased reliability and simplified fabrication result from postassembly preencapsulation passivation process. Photonitride reaction chamber receives silane, ammonia, and mercury from mixing manifold to form passivating coating on IC's. Photonitride layer is barrier to moisture and penetration by mobile ions, and helps to protect IC devices subjected to severe mechanical handling or circuit repair procedures. Process is compatible with variety of wire-bonded lead frame assemblies. Advantages over plasma and sputtering deposition processes are low deposition temperature and zero stray radiation and ion levels.

B80-10261
DOUBLE METALIZATION FOR VLSI
J. D. TROTTER (Mississippi State Univ.) and T. E. WADE (Mississippi State Univ.)
Sep. 1980
M-FS-25149 **Vol. 5, No. 2, p. 232**
Postsintering process increases yield of double-layer metal conductors to almost 100 percent. When wafers containing double-metalized chips are sintered, metal layers react with oxide film remaining in insulation layer holes, breaking it up so that it no longer impedes electric current. Cooling also mechanically disrupts oxide film.

B80-10262
MORE-RELIABLE SOS ION IMPLANTATIONS
D. S. WOO (RCA Corp.)
Sep. 1980
M-FS-25322 **Vol. 5, No. 2, p. 232**
Conducting layer prevents static charges from accumulating during implantation of silicon-on-sapphire MOS structures. Either thick conducting film or thinner film transparent to ions is deposited prior to implantation, and gaps are etched in regions to be doped. Grounding path eliminates charge flow that damages film or cracks sapphire wafer. Prevention of charge buildup by simultaneously exposing structure to opposite charges requires equipment modifications less practical and more expensive than deposition of conducting layer.

B80-10263
OHMIC CONTACT TO GAAS SEMICONDUCTOR
H. J. HOVEL (IBM Corp.) and J. M. WOODALL (IBM Corp.)
Sep. 1980
LANGLEY-12466 **Vol. 5, No. 2, p. 233**
Multimetallic layers produce stable, low-resistance contacts for p-type GaAs and p-type GaAlAs devices. Contacts present no leakage problems, and their series resistance is too small to measure at 1 Sun intensity. Ohmic contacts are stable and should meet 20-year-life requirement at 150 C for GaAs combined photothermal/photovoltaic concentrators.

B80-10264
RESISTANCE WELDING GRAPHITE-FIBER COMPOSITES
R. T. LAMOUREUX (McDonnell Douglas Corp.)
Sep. 1980
MSC-18534 **Vol. 5, No. 2, p. 234**
High-strength joints are welded in seconds in carbon-reinforced thermoplastic beams. Resistance-welding electrode applies heat and pressure to joint and is spring-loaded to follow softening material to maintain contact; it also holds parts together for cooling and hardening. Both transverse and longitudinal configurations can be welded. Adhesive bonding and encapsulation are more time consuming methods and introduce additional material into joint, while ultrasonic heating can damage graphite fibers in composite.

B80-10265
ALL-INORGANIC SPARK-CHAMBER FRAME
T. M. HESLIN
Sep. 1980
GSFC-12354 **Vol. 5, No. 2, p. 235**
Outgassing is reduced by using ceramic and glass materials exclusively. Frames are assembled from four beams with rabbeted ends. Only ceramic or glass adhesives are used, and printed circuit is applied by screen printing directly on beams. Inorganic frames provide stable spark-chamber operation without gas refill, useful in terrestrial gamma-ray studies, in high-energy physics research, and other applications.

B80-10266
CONTROLLING THE SHAPE OF GLASS MICROBALLOONS
S. A. DUNN (Bjorksten Res. Labs., Inc.) and S. GUNTER (Bjorksten Res. Labs., Inc.)
Sep. 1980
M-FS-25230 **Vol. 5, No. 2, p. 236**
Percent yield of 'perfect' glass microballoons is increased by using microlevitating furnaces. Furnace components operate at higher temperatures and with levitation gases that will not affect glass materials. Furnace speeds up remelting and reshaping, reducing number of rejects for laser fusion studies. Electronic sensing maintains constant pressure differential across CHS despite changing furnace pressure and temperature; control retains microballoon in stable levitating state.

B80-10267
FORMING COMPLEX CAVITIES IN CLEAR PLASTIC
T. RILEY, G. MATUSIK, and C. CASTERLINE
Sep. 1980
LEWIS-13412 **Vol. 5, No. 2, p. 237**
Metal casting 'lost wax' process is used to mold plastic parts. Highly economical technique produces optically-clear components of complex shapes, which can be used in complex combustion and manifold systems.

B80-10268
SHRINKING PLASTIC TUBING AND NONSTANDARD DIAMETERS
W. V. RUIZ (Rockwell Intern. Corp.) and C. S. THATCHER (Rockwell Intern. Corp.)
Sep. 1980
MSC-18430 **Vol. 5, No. 2, p. 237**
Process allows larger-than-normal postshrink diameters without splitting. Tetrafluoroethylene tubing on mandrel is supported within hot steel pipe by several small diameter coil sections. Rising temperature of mandrel is measured via thermocouple so assembly can be removed without overshrinking (and splitting) of tubing.

B80-10269
THERMAL BARRIER AND GAS SEAL
J. O. KANE (Rockwell Intern. Corp.) and M. SURBAT (Rockwell Intern. Corp.)
Sep. 1980
MSC-18390 **Vol. 5, No. 2, p. 238**
Resilient baglike seal tolerates thousand-degree temperatures and accommodates small changes in gap size without losing gas-barrier properties; at same time, it maintains smooth aerodynamic surface across gap. Seal includes alumina filler backed by metal plate. Alumina-filled envelope is easily handled and installed, and can be used in high-temperature industrial processes like coal gasification and liquefaction.

B80-10270
HEAT-SHRINKABLE SLEEVE AIDS IN INSULATING UNIVERSAL JOINTS
W. S. GREEN (Rockwell Intern. Corp.) and F. W. THOMPSON (Rockwell Intern. Corp.)
Sep. 1980
MSC-18685 **Vol. 5, No. 2, p. 239**
Tubing stiffens joint so that it can be alined with spline fitting; unsleeved joint would normally droop, making it difficult to attach to splines. Sleeve technique saves time and effort when assembling nonrigid parts by making special holding tools or fixtures unnecessary. Tubing also protects joint from dust and other contamination.

B80-10271
IMPROVED PARTICULATE-SAMPLING FILTER
A. R. HOFFMAN (Caltech) and H. W. SCHNEIDER (Caltech)
Sep. 1980
NPO-14801 **Vol. 5, No. 2, p. 240**
Small surface indentations entrain larger and more representative sampling than conventional petri-dish smeared with smooth layer adhesive. Filter is assembled from perforated disk and flat backing plate with sticky surface. Due to design-created currents, particulates come in contact with surface for longer time and have greater probability of being trapped. Filter is useful in air-quality monitoring at industrial sites, in mines, and in and around nuclear power plants.

B80-10272
TIME-SHAPED RF BRAZING
J. A. STEIN (Rockwell Intern. Corp.) and M. A. VANNASSE

(Rockwell Intern. Corp.)
Sep. 1980
MSC-18617 **Vol. 5, No. 2, p. 240**

One RF generator is controlled from two independent work stations with aid of RF switch and simple control boxes. Brazing may be stopped manually or automatically by external brazing-temperature controller or timer in RF switch housing. Switch is air-operated with water-cooled contacts. If switch loses air pressure, generator stops transmitting power. Time-shared outlet increases utilization and productivity of costly RF generator.

B80-10273
PRODUCING GAPPED-FERRITE TRANSFORMER CORES
W. T. MCLYMAN (Caltech)
Sep. 1980
NPO-14715 **Vol. 5, No. 2, p. 241**

Improved manufacturing techniques make reproducible gaps and minimize cracking. Molded, unfired transformer cores are cut with thin saw and then fired. Hardened semicircular core sections are bonded together, placed in aluminum core box, and fluidized-coated. After winding is run over box, core is potted. Economical method significantly reduces number of rejects.

B80-10274
PLASTIC WELDER
J. D. BUCKLEY, R. L. FOX, and R. J. SWAIN
Sep. 1980
LANGLEY-12540 **Vol. 5, No. 2, p. 242**

Low-cost, self-contained, portable welder joins plastic parts by induction heating. Welder is useable in any atmosphere or in vacuum and with most types of thermoplastic; plastic components can be joined in situ. Device is applicable to aerospace industry and in automobile, furniture, and construction industries. Power requirements are easily met by battery or solar energy. In welder, toroidal inductor transfers magnetic flux through thermoplastic to screen. Heated screen causes plastic surface on either side to melt and flow into it to form joint.

B80-10275
ELECTRON-BEAM WELDER CIRCLE GENERATOR
R. K. BURLEY (Rockwell Intern. Corp.)
Sep. 1980
M-FS-19441 **Vol. 5, No. 2, p. 243**

Generator rotates electron beam and performs other convenient functions during welding process. Device eliminates time-consuming techniques relying heavily on operator's skill. Welding speed is varied with frequency selector, and amplitudes of x- and y-axes are varied by adjusting phase shift. Both high and low-range adjustments are available, and each axis can be separately controlled. Crosshair is provided for set-up and beam alinements.

B80-10276
'FOREIGN MATERIAL' TO VERIFY ROOT FUSION IN WELDED JOINTS
R. E. KLEINT (Rockwell Intern. Corp.)
Sep. 1980
M-FS-19496 **Vol. 5, No. 2, p. 243**

Foil or thin wire at weld root is used to verify weld penetration. When weld is adequate, material mixes with weld and traces of it diffuse to weld crown. Spectroscopic analysis of samples identifies foreign material and verifies root has fused. Weld roots are usually inaccessible to visual inspection, and X-ray and ultrasonic inspection techniques are not always reliable. Good results are obtained with use of gold/nickel alloy.

B80-10277
TUBE-WELDER AIDS
J. F. WEAVER (Rockwell Intern. Corp.)
Sep. 1980
MSC-18687 **Vol. 5, No. 2, p. 244**

Simple tools assist in setting up and welding tubes. Welder aids can be easily made to fit given tube diameter. Finished set can be used repeatedly to fix electrode-to-weld gap and mark sleeve and joint positions. Tools are readily made in tube-manufacturing plants and pay for themselves in short time in reduced labor costs and quality control: Conventional measurements are too slow for mass production and are prone to errors.

B80-10278
HONING FIXTURE FOR WELDED ELECTRODES
R. F. NICHOLAS (Rockwell Intern. Corp.) and W. H. SCHUBERT (Rockwell Intern. Corp.)
Sep. 1980
M-FS-19537 **Vol. 5, No. 2, p. 244**

Fixture for refacing electrodes mounts directly on welding machine. Up-and-down movement of stone against electrode is done manually or with designed motor drive. Fixture is used in lieu of manually refinishing electrodes with emory paper or other abrasive. It produces uniformly flat, parallel electrodes in less time, saving cost on production time.

B80-10279
SILICON NITRIDE PASSIVATION OF IC'S
J. J. ERICKSON (Hughes Aircraft Co.), F. L. GEBHART (Hughes Aircraft Co.), T. C. HALL (Hughes Aircraft Co.), and J. W. PETERS (Hughes Aircraft Co.)
Sep. 1980
M-FS-25309 **Vol. 5, No. 2, p. 245**

Feasibility study looks at effectiveness of silicon nitride passivation coating against moisture and mobile ions. Coating was tested on CMOS microcircuits. Tests included temperature cycling, high-temperature electrical stress, and temperature and humidity exposure. Report concludes plastic-encapsulated circuits with protective coating exhibit high survival rates; it includes tables summarizing test results and figures that show effects of flexing.

B80-10280
PROGRESS IN MOSFET DOUBLE-LAYER METALIZATION
J. D. GASSAWAY (Mississippi State Univ.), J. D. TROTTER (Mississippi State Univ.), and T. E. WADE (Mississippi State Univ.)
Sep. 1980
M-FS-25239 **Vol. 5, No. 2, p. 246**

Report describes one-year research effort in VLSL fabrication. Four activities are described: theoretical study of two-dimensional diffusion in SOS (silicon-on-sapphire); setup of sputtering system, furnaces, and photolithography equipment; experiments on double layer metal; and investigation of two-dimensional modeling of MOSFET's (metal-oxide-semiconductor field-effect transistors).

B80-10281
OPTIMIZING COSTS OF VLSI CIRCUITS
K. B. COOK, JR. (Auburn Univ.) and D. V. KERNS, JR. (Auburn Univ.)
Sep. 1980
M-FS-25348 **Vol. 5, No. 2, p. 246**

Report analyzes costs of developing and producing low-production-volume, customized VLSI (very large-scale, integrated) circuits. Relationship is developed between IC cost and electronic system cost using IC cost models based on design/fabrication approach. Emphasis is on development of understanding between cost and volume for custom circuits to be used by NASA. Reliability is major cost component in models. Report is divided into five sections and includes four appendices with useful reference literature.

B80-10282
AN AUTOMATED OXIDE AND DIFFUSION FACILITY FOR IC'S
B. W. KENNEDY
Sep. 1980
M-FS-25357 **Vol. 5, No. 2, p. 246**

Report discusses totally-automated oxidation and diffusion facility for fabricating IC's. Several innovations are demonstrated: process controller specifically designed for semiconductor processing; automatic loading system to accept wafers from air track, insert them in quartz carrier, and place carrier on paddle for insertion into furnace; automatic unloading of wafers back onto air track; and boron diffusion using diborane.

B80-10283
PREDICTING CRACK PROPAGATION
T. HU (Rockwell Intern. Corp.)
Sep. 1980
MSC-18718 **Vol. 5, No. 2, p. 247**
Flaw growth under load is predicted in two dimensions with Advanced Crack Propagation Predictive Analysis Program (FLAGRO4). FLAGRO4 accommodates variety of cracks, crack transitions, stress gradients, changes in material properties, and Willenberg retardation. Program is written in FORTRAN IV for batch execution and is available for CDC and IBM machines.

B80-10417
CONTOUR-MEASURING TOOL FOR COMPOSITE LAYUPS
M. J. FONTES
Jan. 1981
ARC-11246 **Vol. 5, No. 3, p. 383**
Simple handtool helps form contours and complex shapes from laminae of resin-impregnated fabric. Tool, which consists of yoke having ballpoint pen and spindle and gage, is placed so that it straddles model. As toll is moved, pen draws constant thickness focus that is used as template.

B80-10418
A NEW FAMILY OF FIRE-RESISTANT FOAMS
J. GAGLIANI (International Harvester Co.)
Jan. 1981 See also NASA-CR-160576 (N80-22492); B78-10053
MSC-16921 **Vol. 5, No. 3, p. 384**
Need for lightweight flame-resistant, nonsmoking materials in interiors of spacecraft has spawned family of foams that could find applications in aircraft and other vehicles. Polyimide-based foams are being developed as resilient fillers for seat cushions, as rigid, low-density wall panels, as high-strength sheets for floors, and as thermal and acoustical insulation.

B80-10419
MODIFIED FIRE-RESISTANT FOAMS FOR SEAT CUSHIONS
J. GAGLIANI (International Harvester Co.), R. LEE (International Harvester Co.), U. A. K. SORATHIA (Intern Harvester Co.), and A. L. WILCOXSON (Intern. Harvester Co.)
Jan. 1981
MSC-18704 **Vol. 5, No. 3, p. 385**
Modified polyimide-polymer resins are precursors for new family of resilient fire-resistant foams. Terpolyimide foams containing long-chain aliphatic diamines withstand 50,000 cycles of compression over a 200 pound load - an equivalent of 3 years of continuous use as seat cushion filler.

B80-10420
ONE-STEP MICROWAVE FOAMING AND CURING
J. GAGLIANI (International Harvester Co.), R. LEE (International Harvester Co.), U. A. K. SORATHIA (International Harvester Co.), and A. L. WILCOXSON (International Harvester Co.)
Jan. 1981 See Also NASA-CR-160576(N80-22492); NASA-CR-151472 (N77-28301)
MSC-18707 **Vol. 5, No. 3, p. 386**
Process that combines microwave foaming and curing of polyimide precursors in single step produces fire-resistant foam slabs of much larger volume than has previously been possible. By adding selected conductive fillers to powder precursors and by using high-power microwave oven, foam slabs with dimensions in excess of 61 by 61 by 7.6 cm are made. Typical foaming and curing and curing time is 35 minutes in microwave oven with additional 1 to 2 hour postcure in conventional oven.

B80-10421
RIGID FIRE-RESISTANT FOAMS FOR WALLS AND FLOORS
J. GAGLIANI (International Harvester Co.), R. LEE (International Harvester Co.), U. A. K. SORATHIA (International Harvester Co.), and A. L. WILCOXSON (International Harvester Co.)
Jan. 1981 See also NASA-CR-160576 (N80-22492); NASA-CR-151472 (N77-28301)
MSC-18708 **Vol. 5, No. 3, p. 386**
Previous techniques for fabricating rigid fire-resistant polyimide foams by compressing already-foamed precursor have been supplanted by one-step constrained-rise process. Precursor mixed with reinforcing fillers is placed between rigid substrates that constrain expansion of foam as it is heated by microwave energy. Process works for both liquid and powder precursors and can also be adapted to attach woven fiberglass skins at same time prcursor is being foamed.

B80-10422
HOT FORMING GRAPHITE/POLYIMIDE STRUCTURES
R. M. BAUCOM and P. W. KIDDER (LTV)
Jan. 1981
LANGLEY-12547 **Vol. 5, No. 3, p. 387**
Hot forming process has been developed in which structural shapes and panels are fabricated directly from stabilized graphite/polyimide preforms. Process can be used with thermosetting polymers that have high-temperature melt phase just before final cure. This phase allows fibers to move without destroying matrix-to-fiber adhesion. One of key advantages of this process is that prestages preforms are very stable and do not require refrigerated storage.

B80-10423
METHOD FOR SHAPING POLYETHYLENE TUBING
R. C. KRAMER (Rockwell International Corp.)
Jan. 1981
MSC-18771 **Vol. 5, No. 3, p. 388**
Method forms polyethylene plastic tubing into configurations previously only possible with metal tubing. By using polyethylene in place of copper or stain less steel tubing inlow pressure systems, fabrication costs are significantly reduced. Polyethylene tubing can be used whenever low pressure tubing is needed in oil operations, aircraft and space applications, powerplants, and testing laboratories.

B80-10425
FILM COATINGS FOR CONTOURED SURFACES
H. E. FLANERY (Rockwell International Corp.), R. K. FROST (Rockwell International Corp.), and A. J. OLSON (Rockwell International Corp.)
Jan. 1981
MSC-18784 **Vol. 5, No. 3, p. 389**
Thickness of fluorocarbon elastomer films applied in contoured shapes by vacuum forming is difficult to control at sharply curved areas. Process for spraying contoured fluorocarbon elastomer films of uniform strength and thickness has been used instead of vacuum forming to fabricate curtain covering external tank of Space Shuttle. Conventional spray equipment may be used.

B80-10426
KILOVOLT VACUUM FEED THROUGH IS LESS NOISY
L. D. HOWELL (ITT)
Jan. 1981
NPO-14802 **Vol. 5, No. 3, p. 390**
Electrical feedthrough connects both low-voltage and high-voltage signals between cryogenic environment and 'outside world.' Developed for cooled germanium gamma-ray detector, feedthrough has especially low capacitance and low sensitivity to microphonic noise. Its high-voltage lead is free of corona discharge and electrical breakdown to at least 5 kV.

B80-10427
CUTTING HOLES IN FABRIC-FACED PANELS
S. A. PETERSON (Rockwell International Corp.)
Jan. 1981
MSC-18786 **Vol. 5, No. 3, p. 391**
Tool has 2 carbide inserts that bore clean holes through fibrous material with knifelike slicing action. Cutting edge of insert is curved, with plane inner surface at 30 degree angle to tool axis. Drill press or hand-held drill can be used to hold cutting tool.

B80-10428
SEALING MICROPORES IN THIN CASTINGS
G. A. MERSEREAU (Honeywell, Inc.), G. O. NITZSCHKE (Honeywell, Inc.), H. L. OCHS (Honeywell, Inc.), and F. S. SUTCH

(Honeywell, Inc.)
Jan. 1981
MSC-18623 **Vol. 5, No. 3, p. 391**
Microscopic pores in thin-walled aluminum castings are sealed by impregnation pretreatment. Technique was developed for investment castings used in hermetically sealed chassic for electronic circuitry. Excessively high leakage rates were previously measured in some chassis.

B80-10429
LIGHTWEIGHT TERMINAL BOARD
J. D. DRECHSLER (Rockwell International Corp.) and H. EATON (Rockwell International Corp.)
Oct. 1981
MSC-18787 **Vol. 5, No. 3, p. 393**
Sandwich construction for terminal boards reduces fabrication time and produces thinner boards with better insulation consistency, better apperance, and less weight. New method also permits closer spacing of terminal posts. Method starts with thin (0.031 inch) sheet of polyimide and consists of drilling, inserting terminal posts, upsetting ends, and then bonding second sheet to upset side as continuous insulation member. Resulting sandwich is lighter and much cheaper than single board.

B80-10430
TRANSISTOR PACKAGE FOR HIGH PRESSURE APPLICATIONS
P. J. ZANTOS (Rockwell International Corp.)
Jan. 1981
MSC-18743 **Vol. 5, No. 3, p. 393**
TO63 transistor package can operate in hydraulic oil ar pressures of 200 psi or greater without leakage failure if it is reinforced by alumina disk brazed to cap and terminals. This inexpensive modification has been used successfully on power transistors in hydraulic circulating-pump assemblies for Space Shuttle orbiter and should be effective in other pressurized environments, such as in oil exploration equipment.

B80-10431
AUTOMATIC CHEMICAL VAPOR DEPOSITION
B. W. KENNEDY
Jan. 1981
M-FS-25249 **Vol. 5, No. 3, p. 393**
Report reviews chemical vapor deposition (CVD) for processing integrated circuits and describes fully automatic machine for CVD. CVD proceeds at relatively low temperature, allows wide choice of film compositions (including graded or abruptly changing compositions), and deposits uniform films of controllable thickness at fairly high growth rate. Report gives overview of hardware, reactants, and temperature ranges used with CVD machine.

B80-10432
CADAT LOGIC SIMULATION PROGRAM
C. L. MITCHELL (M & S Computing, Inc.) and J. F. TAYLOR (M & S Computing, Inc.)
Jan. 1981 See also B80-10437
M-FS-25183 **Vol. 5, No. 3, p. 394**
CADAT Logic Simulation Program (LOGSIM) checks functional correctness of electronic logic circuit by simulating circuit at logic gate level. LOGSIM also checks propagation delay through logic nets and indicates any timing or 'race' problems.

B80-10433
CADAT TEST PATTERN GENERATOR
Innovator not given (M & S Computing Co.) Jan. 1981
M-FS-25066 **Vol. 5, No. 3, p. 394**
CADAT test pattern generator (TPG) aids in checkout, fault detection, and fault isolation of complex digital circuits. Time and effort of manually generating digital test patterns can be major limiting factor in effectively utilizing automatic testing. This time and effort are reduced from several months to several days by TPG.

B80-10434
CADAT FIELD-EFFECT-TRANSISTOR SIMULATOR
Innovator not given (RCA Corp.) Jan. 1981
M-FS-25067 **Vol. 5, No. 3, p. 395**
CADAT field-effect transistor simulator (FETSIM) analyzes dc and transient behavior of metal-oxide-semiconductor (MOS) circuits. Both N-MOS and P-MOS transistor configurations in either bulk of silicon-on-sapphire (SOS) technology and almost any combination of R/C elements are analyzed.

B80-10435
CADAT PLACE-AND-ROUTINE IN TWO DIMENSIONS
Innovator not given (RCA Corp.) Jan. 1981
M-FS-25058 **Vol. 5, No. 3, p. 395**
CADAT place-and-route-in-two dimensions program (PR2D) is standard-cell automatic-layout program for generating large-scale-integrated/metal-oxidesemiconductor (LSI/MOS) arrays. PR2D translates logic designer's cell interconnection requirements into physically-defined MOS chip. PR2D reads input data, searches pin data file for data on each pattern type, generates placement of patterns, and interconnects patterns. As output, it generates artwork for layouts.

B80-10436
CADAT MULTIPORT PLACEMENT AND ROUTING
Innovator not given (RCA Corp.) Jan. 1981
M-FS-25065 **Vol. 5, No. 3, p. 396**
CADAT multiport-in-two dimensions program (MP2D) is powerful placement and routing aid for processing double-ended cell equivalents of high-speed silicon-on-sapphire (SOS) standard-cell family. Basic purpose of MP2D is to design high-density large-integrated (LSI) arrays.

B80-10437
CADAT INTEGRATED CIRCUIT MASK ANALYSIS
Innovator not given (M & S Computing Co.) Jan. 1981 See also B80-10432
M-FS-25054 **Vol. 5, No. 3, p. 396**
CADAT System Mask Analysis Program (MAPS2) is automated software tool for analyzing integrated-circuit mask design. Included in MAPS2 functions are artwork verification, device identification, nodal analysis, capacitance calculation, and logic equation generation.

B80-10534
'DENSIFIED' TILES FORM STRONGER BONDS
R. L. DOTTS and J. W. HOLT (Rockwell International Corp.)
Apr. 1981 See also B80-10535
MSC-18741 **Vol. 5, No. 4, p. 495**
Application of colloidal silica more than doubles bond strength of ceramic tile/substrate attachments. 'Densification' process strengthens surface where tile attaches to felt strain-isolator pad, redistributing stresses and preventing failures at that point. First, isopropyl alcohol is applied to bottom tile surface. Second, aqueous mixture of cementing colloidal silica and reinforcing ball-milled silica particles is painted on tile. Finally, after drying, tile is rewaterproofed by exposure to vapors or methyltrimethoxysilane and acetic acid.

B80-10535
TILE DENSIFICATION WITH TEOS
G. M. ECORD and C. SCHOMBURG
Apr. 1981
MSC-18737 **Vol. 5, No. 4, p. 495**
Densification process uses brushed or sprayed coating of tetraethyl orthosilicate. Liquid is applied and cured in three steps; tile weight increase averages 0.15 g per square centimeter. TEOS liquid is prepared by mixing TEOS with hydrochloric acid and adding marking dye. TEOS application provides variable stiffness, strength, and penetration. Surface of tile shows no buidup and is more durable for additional coatings.

B80-10536
REPAIRING HIGH-TEMPERATURE GLAZED TILES
G. M. ECORD and C. SCHOMBURG
Apr. 1981
MSC-18736 **Vol. 5, No. 4, p. 496**
Tetraethyl orthosilicate (TEOS) mixture fills chips and cracks in glazed tile surface. Filler is made by mixing hydrolyzed TEOS,

silicon tetraboride powder, and pulverized tile material. Repaired tiles survived testing by intense acoustic emissions, arc jets, and intense heat radiation. Repair is reliable and rapid, performed in 1-1 1/2 hours with tile in any or orientation.

B80-10537
PRODUCING SILICON CONTINUOUSLY
W. M. INGLE (Motorola, Inc.), R. S. ROSLER (Motorola, Inc.), and S. THOMPSON (Motorola, Inc.)
Apr. 1981
NPO-14796 **Vol. 5, No. 4, p. 497**
Fluid-bed vaporization followed by chemical vapor deposition generates large, semiconductor-grade silicon particles. Method is economical, high-volume alternative to conventional batch-processing methods. Harvested chunks, extracted in cyclone separator, are about 0.5 to 1.3 centimeters in diameter. Process is not limited to polymer feedstock; it utilizes any halosilane intermediate used in silicon production.

B80-10538
MOBILE GLAZING UNIT
J. W. HOLT (Rockwell International Corp.)
Apr. 1981 See also NASA-N81-70850
KSC-11171 **Vol. 5, No. 4, p. 498**
Unit programs thermal cycle from 100 to 2,300 F for firing ceramic glaze coatings on refractory surfaces in any attitude and position. Device includes control console, heater assembly, protective cover, and manipulator boom; boom places heater next to surface to be fired. Unit is industrially useful for in situ repair of ceramics and curing individual refractory blocks during furnace maintenance.

B80-10539
LEARNING HIGH-QUALITY SOLDERING
W. S. READ (Caltech)
Apr. 1981
NPO-14869 **Vol. 5, No. 4, p. 499**
Soldering techniques for high-reliability electronic equipment are taught in 5 day course at NASA's Jet Propulsion Laboratory. Topic covered include new circuit assembly, printed-wiring board reworking, circuit changes, wire routing, and component installation.

B80-10540
ELIMINATING GAPS IN SPLIT RINGS
R. W. GOULD (Rockwell International Corp.)
Apr. 1981
MSC-18854 **Vol. 5, No. 4, p. 500**
Simple installation method allows thinner, lighter tether rings than conventional procedures, saving expensive materials. Installer inverts ring with pliers before it is slid over cable, then returns it to its original position after installation. Ring is in correct orientation, and coils are tightly compressed for high reliability fastening.

B80-10541
PASSIVATION LAYER FOR STEEL SUBSTRATE OF SOLAR CELL
R. J. STIRN (Caltech) and Y. M. YEH (Caltech)
Apr. 1981
NPO-14961 **Vol. 5, No. 4, p. 501**
Solar cell is fabricated on commercial sheet-steel substrate passivated with tungsten layer. Layer prevents constituents of steel from interacting with semiconductor materials in MOS thin-film solar cell. Thin plating of nickel on steel improves bonding of tungsten. Use of steel as substrate reduces materials cost of solar cell construction.

B80-10542
LOW-COST CONCENTRATING MIRRORS
T. R. CARROLL (Caltech)
Apr. 1981
NPO-14962 **Vol. 5, No. 4, p. 502**
Parabolic concentrators used in solar-energy systems are constructed from many flat rectangular mirrors. Each mirror is elastically deformed in one dimension. Several such mirrors placed adjacent to each other along parabolic curve form inexpensive mirror suitable for solar application.

B80-10543
SPIRAL-WOUND GASKET FORMS LOW-TEMPERATURE SEAL
S. C. IRICK
Apr. 1981
LANGLEY-12315 **Vol. 5, No. 4, p. 502**
Spiral-wound cryogenic gasket with one component requires no encapsulant and is easily produced with self-locking features. Seal either opens and closes or is fixed. It is made by skiving strip from circumference of disk of glass-filled material. Successive turns of strip are spirally wrapped in groove machined into one flange surface. Closing joint compresses gasket.

B80-10544
ARC SPRAYING SOLDERABLE TABS TO GLASS
J. LINDMAYER (Solarex Corp.)
Apr. 1981
NPO-14853 **Vol. 5, No. 4, p. 503**
Tabs suitable for electrical or mechanical connections in solar cells and integrated circuits are made by spraying technique. Solder wets copper, copper bonds to aluminum, and aluminum adheres to glass. Arc spraying is automated and integrated with encapsulation, eliminating hand tabbing, improving reliability, and reducing cost.

B80-10545
BACK CONTACTS FOR SILICON-ON-CERAMIC SOLAR CELLS
T. L. SCHULLER (Honeywell, Inc.) and S. MARQUARDT (Honeywell, Inc.)
Apr. 1981
NPO-14809 **Vol. 5, No. 4, p. 504**
Grooved substrate exposes back surface of photovoltaic cells, allowing dopant diffusion into surface and electrical contact. When substrate is coated successively with carbon and molten silicon, polycrystalline-silicon bridges form over grooves, but leave channels open. Best adhesion results when substrate grooves run perpendicular to direction of liquid-silicon layer and are closely spaced.

B80-10546
SELF-LUBRICATING GEARSET
D. S. BINGE (RCA Corp.)
Apr. 1981
MSC-18801 **Vol. 5, No. 4, p. 504**
Gearset fabricated from molybdenum sulfide filled polyimide allows attention-free operation in vacuum and at extreme temperatures. Ring gear drives pinion gear on shaft in skewed-axis arrangement. Because loads are shared among multiple meshing teeth, self-lubricating material is strong enough to accomodate high gear ratio.

B80-10547
REFLECTING LAYERS REDUCE WEIGHT OF INSULATION
J. D. COLE (Rockwell International Corp.), E. D. SCHLESSINGER (Rockwell International Corp.), and H. J. ROCKOFF (Rockwell International Corp.)
Apr. 1981
MSC-18785 **Vol. 5, No. 4, p. 505**
Metalized films placed between layers of fibrous material maintain equivalent thermal conductivity while cutting blanket density in half. Tests indicate that insulation with 1 lb/cu ft density with goldized films has thermal conductivity equal to 2 lb/cu ft of conventional insulation. Concept reduces weight in commercial aircraft and increases cargo space.

B80-10548
LIGHTWEIGHT CRYOGENIC VESSEL
J. C. LEWIS (Caltech)
Apr. 1981
NPO-14794 **Vol. 5, No. 4, p. 505**
Thin cooling jacket of recirculating liquid nitrogen is contained by relatively thin walls. Nitrogen is maintained at slight positive

pressure, unlike full atmospheric pressure of conventional Dewar design, eliminating need for evacuated insulating spaces and heavy-walled shells. Besides cryogenic applications, design keeps liquids hot when recirculating liquid hotter than nitrogen is used.

B80-10549
DROP TOWER WITH NO AERODYNAMIC DRAG
J. M. KENDALL, JR. (Caltech)
Apr. 1981
NPO-14845 **Vol. 5, No. 4, p. 506**
Cooling air accelerated to match velocity of falling object eliminates drag. 3 meter drop tower with suction fan and specific geometry causes air to accelerate downward at 1 g. Although cooling of molten material released from top is slow because surrounding air moves with it, drop remains nearly spherical.

B80-10550
NICKEL-DOPED SILICON FOR SOLAR CELLS
A. M. SALAMA (Caltech)
Apr. 1981
NPO-14780 **Vol. 5, No. 4, p. 507**
Large grain boundaries in polycrystals act as gettering centers for nickel precipitates, improving cell performance. Effects are described in report. Data on open-circuit voltage, short-circuit current, maximum power, and conversion efficiency for illuminated cells are compared with values for undoped cells. Dark forward current versus voltage is also measured for cell types.

B80-10551
CADAT NETWORK TRANSLATOR
E. R. PITTS (M&S Computing, Inc.)
Apr. 1981 See also B80-10432 - B80-10437
M-FS-25055 **Vol. 5, No. 4, p. 507**
Program converts cell-net data into logic-gate models for use in test and simulation programs. Input consists of either Place, Route, and Fold (PRF) or Place-and-Route-in-Two-Dimensions (PR2D) layout data deck. Output consists of either Test Pattern Generator (TPG) or Logic-Simulation (LOGSIM) logic circuitry data deck. Designer needs to build only logic-gate-model circuit description since program acts as translator. Language is FORTRAN IV.

B80-10552
CADAT INTEGRATED CIRCUIT ARTWORK PROGRAM
R. L. KVELTHAU (M&S Computing, Inc.)
Innovator not given (RCA Corp.) Apr. 1981 See also B80-10551
M-FS-25017 **Vol. 5, No. 4, p. 508**
Versatile, ready-to-use program (ARTWORK) converts artwork data into mask patterns. ARTWORK generates signals for controlling mask-fabricating equipment. Extensive utility package enables user to create new pattern libraries, develop and incorporate new cells, and perform systems orientation functions. Program is written in FORTRAN IV.

09 MATHEMATICS AND INFORMATION SCIENCES

B80-10142
EFFICIENT TELEMETRY FORMAT
E. GREENBERG (Caltech) and A. J. HOOKE (Caltech)
Aug. 1980
NPO-13679 **Vol. 5, No. 1, p. 119**
Format would simplify ground processing of telemetry data. Also, missing minor frame would create error in only one set of source data instead of disrupting all sets. Format organizes data from various sources into autonomous blocks. Data are pre-processed, in effect, so main computer only needs to determine block type and process data set as batch.

B80-10143
USER'S GUIDE TO SFTRAN
T. E. FESSLER and W. F. FORD
Aug. 1980
LEWIS-13172 **Vol. 5, No. 1, p. 119**
Structured programming language has been given new features and some limitations are removed. Language runs more efficiently, and concepts of top down development and modularity are extended to task management.

B80-10144
GODDARD MISSION ANALYSIS SYSTEM
F. E. MCGARRY
Aug. 1980
GSFC-12392 **Vol. 5, No. 1, p. 120**
Collection of software modules can be configured to solve variety of mission analysis problems. GMAS includes modules for performing large selection of standard mission analyses. Graphics executive system is provided. Program is in FORTRAN IV and Assembler for and interactive execution on IBM 360-series.

B80-10145
SOFTWARE DESIGN AND DOCUMENTATION LANGUAGE
H. KLEINE (Caltech)
Aug. 1980
NPO-14610 **Vol. 5, No. 1, p. 121**
Language supports design and documentation of complex software. Included are: design and documentation language for expressing design concepts; processor that produces intelligible documentation based on design specifications; and methodology for using language and processor to create well-structured top-down programs and documentation. Processor is written in SIMSCRIPT 11.5 programming language for use on UNIVAC, IBM, and CDC machines.

B80-10146
ESTIMATION OF INCOMPLETE MULTINOMIAL DATA
K. R. CREDEUR
Aug. 1980
LANGLEY-12593 **Vol. 5, No. 1, p. 121**
Program estimates cell probabilities for data observed to fall in one of two or more categories when exact category cannot be determined. Data are assumed to be randomly incomplete. Estimation minimizes risk of quadratic loss. Program should be useful in projects where multinomial data is analyzed, but where observations are sometimes incomplete. Program is in FORTRAN IV and Assembler for batch execution on CYBER 173.

B80-10147
AUTOMATED FLOW-CHART SYSTEM
W. WOODFORD
Aug. 1980
GSFC-12514 **Vol. 5, No. 1, p. 121**
Program produces flow chart of any program written in FORTRAN. Each FORTRAN statement is printed with symbol representing actions required during execution. Flow chart is generated on line-printer. This program is in COBOL for batch execution on IBM 370-series computer.

B80-10148
SYSTEMS IMPROVED NUMERICAL DIFFERENCING ANALYZER
Innovator not given (Johnson Space Center) Aug. 1980
MSC-18597 **Vol. 5, No. 1, p. 122**
Program solves physical problems governed by diffusion-type equations, provided that equations can be modeled by lumped-parameter representation. Program is used for thermal analysis, and could be adapted to solve Fourier, Poisson, and Laplace differential equations. Program is in FORTRAN IV and Assembler for execution on UNIVAC 1100-series or CYBER 175.

B80-10284
AN APPROXIMATION TO STUDENT'S T-DISTRIBUTION
D. R. RUMMLER and C. W. STOUD
Sep. 1980
LANGLEY-12238 **Vol. 5, No. 2, p. 251**

Three equations relate Student's t-distribution to standard normal distribution with maximum error of less than 0.8 percent. First equation, used for degrees of freedom (v) greater than 2, expresses t variable in terms of standard normal variable z. For v = 1 and 2, second and third equations express t exactly in terms of probability P.

B80-10285
LOW-COST LANDSAT PROCESSING SYSTEM
N. L. FAUST (Metrics, Inc.), N. J. HOOPER (Metrics, Inc.), and G. W. SPANN (Metrics, Inc.)
Sep. 1980
M-FS-25396 **Vol. 5, No. 2, p. 252**
LANDSAT analysis system is assembled from commercially available components at relatively low cost. Small-scale system is put together for price affordable for state agencies and universities. It processes LANDSAT data for subscene areas on repetitive basis. Amount of time required for processing decreases linearly with number of classifications desired. Computer programs written in FORTRAN IV are available for analyzing data.

B80-10286
NASA PERT TIME II
R. C. BAINBRIDGE, F. FUNICELLI, D. J. HIRSCH, E. A. PALLAT, E. RYAN, J. D. WALKER, and H. BREMMER
Sep. 1980
LEWIS-13145 **Vol. 5, No. 2, p. 252**
Program Evaluation and Review Technique (PERT) is disciplined management technique involving computer processing. NASA PERT Time 11 gives project manager insight into current and future project development and forewarns of potential problems. Program utilizes modular technique. Module is 'fragnet'; once aspects of project are described in terms of fragnets, control network is automatically generated. Program is written in FORTRAN IV and OS Assembler for batch execution and has been implemented on IBM 370.

B80-10287
LINEAR STOCHASTIC OPTIMAL CONTROL AND ESTIMATION PROBLEM
L. C. GEYSER and F. K. B. LEHTINEN
Sep. 1980
LEWIS-13206 **Vol. 5, No. 2, p. 253**
Problem involves design of controls for linear time-invariant system disturbed by white noise. Solution is Kalman filter coupled through set of optimal regulator gains to produce desired control signal. Key to solution is solving matrix Riccati differential equation. LSOCE effectively solves problem for wide range of practical applications. Program is written in FORTRAN IV for batch execution and has been implemented on IBM 360.

B80-10288
MULTIPLE LINEAR REGRESSION ANALYSIS
T. R. EDWARDS
Sep. 1980
M-FS-23764 **Vol. 5, No. 2, p. 254**
Program rapidly selects best-suited set of coefficients. User supplies only vectors of independent and dependent data and specifies confidence level required. Program uses stepwise statistical procedure for relating minimal set of variables to set of observations; final regression contains only most statistically significant coefficients. Program is written in FORTRAN IV for batch execution and has been implemented on NOVA 1200.

B80-10289
STRUCTURED FORTRAN PREPROCESSOR
S. AUSTIN (Science Applications, Inc.), B. BUCKLES (Science Applications, Inc.), and J. P. RYAN (Science Applications, Inc.)
Sep. 1980
M-FS-23813 **Vol. 5, No. 2, p. 254**
Structured-programming features simplify software design. Programmer needs only few control statements to code program in format easy to debug and maintain, freeing him/her from flow constraints of standard FORTRAN. Program is written in ANSI FORTRAN and is compatible with machine supporting FORTRAN compiler that accepts ANSI statements. It has been implemented on IBM 370.

B80-10290
MBASIC PROCESSOR
R. B. HARTLEY (Caltech) and R. E. HOLZMAN (Caltech)
Sep. 1980
NPO-14245 **Vol. 5, No. 2, p. 254**
MBASIC is high-level, interactive computer language that reduces time of computer task programming. Outstanding features of MBASIC include: multiple assignments or statements in single instruction; conditional, assignment, and repetitive statement modifiers; and excellent string-handling capabilities. Two machine versions are available: UNIVAC (written in reentrant Assembler code for execution under EXEC 8) AND DEC-10 (written in Assembler code for execution under TOPS-10).

B80-10291
BASIC CLUSTER COMPRESSION ALGORITHM
E. E. HILBERT (Caltech) and J. LEE (Caltech)
Sep. 1980
NPO-14816 **Vol. 5, No. 2, p. 255**
Feature extraction and data compression of LANDSAT data is accomplished by BCCA program which reduces costs associated with transmitting, storing, distributing, and interpreting multispectral image data. Algorithm uses spatially local clustering to extract features from image data to describe spectral characteristics of data set. Approach requires only simple repetitive computations, and parallel processing can be used for very high data rates. Program is written in FORTRAN IV for batch execution and has been implemented on SEL 32/55.

B80-10292
SYSTEM TIME-DOMAIN SIMULATION
C. T. DAWSON, T. W. EGGLESTON, A. C. GORIS, M. FASHANO (Hughes Aircraft Co.), D. PAYNTER (Hughes Aircraft Co.), and W. H. TRANTER (Missouri Univ.)
Sep. 1980
MSC-18333 **Vol. 5, No. 2, p. 255**
Complex systems are simulated by engineers without extensive computer experience. Analyst uses free-form engineering-oriented language to input 'black box' description. System Time Domain (SYSTID) Simulation Program generates appropriate algorithms and proceeds with simulation. Program is easily linked to postprocessing routines. SYSTID program is written in FORTRAN IV for batch execution and has been implemented on UNIVAC 1110 under control of EXEC 8, Level 31.

B80-10293
IMAGE-BASED INFORMATION, COMMUNICATION, AND RETRIEVAL
N. A. BRYANT (Caltech) and A. L. ZOBRIST (Caltech)
Sep. 1980
NPO-14893 **Vol. 5, No. 2, p. 256**
IBIS/VICAR system combines video image processing and information management. Flexible programs require user to supply only parameters specific to particular application. Special-purpose input/output routines transfer image data with reduced memory requirements. New application programs are easily incorporated. Program is written in FORTRAN IV, Assembler, and OS JCL for batch execution and has been implemented on IBM 360.

B80-10438
AN IMAGE-DATA-COMPRESSION ALGORITHM
E. E. HILBERT (Caltech) and R. F. RICE (Caltech)
Jan. 1981
NPO-14496 **Vol. 5, No. 3, p. 399**
Cluster Compression Algorithm (CCA) preprocesses LANDSAT image data immediately following satellite data sensor (receiver). Data are reduced by extracting pertinent image features and compressing this result into concise format for transmission to ground station. This results in narrower transmission bandwidth, increased data-communication efficiency, and reduced computer time in reconstructing and analyzing image. Similar technique could be applied to other types of recorded data to cut costs of

transmitting, storing, distributing, and interpreting complex information.

B80-10439
DETERMINING MANUFACTURING COST FROM PRODUCT COMPLEXITY
L. M. DELIONBACK
Jan. 1981
M-FS-25371 **Vol. 5, No. 3, p. 400**
Procedure allows calculation of manufacturing complexity - the totality of cost elements that determine cost of manufacturing unit. Procedure is based on premise that manufacturing follows learning curve; that is costs are assumed to decrease as experience is acquired and improvements are made in design, tooling, and methods.

B80-10553
AN APPROXIMATION FOR INVERSE LAPLACE TRANSFORMS
W. M. LEAR (TRW, Inc.)
Apr. 1981 See also NASA-TM-81064(N80-25056)
MSC-18867 **Vol. 5, No. 4, p. 511**
Programmable calculator runs simple finite-series approximation for Laplace transform inversions. Utilizing family of orthonormal functions, approximation is used for wide range of transforms, including those encountered in feedback control problems. Method works well as long as F(t) decays to zero as it approaches infinity and so is appliable to most physical systems.

B80-10554
SAFETY ANALYSIS FOR COMPLEX SYSTEMS
J. P. ONESTY (Rockwell International Corp.) and R. L. PEERCY, JR. (Rockwell International Corp.)
Apr. 1981
MSC-18745 **Vol. 5, No. 4, p. 511**
Operational risk assessment considers hardware, environment, and human factors. Technique starts with division of postulated mission into segments which are further subdivided into separate operational steps. Consequences of steps, nonoccurrence, premature operation, out-of-sequence operation, and inadvertent execution are examined at subevent, event, and phase levels. Hazards are identified and treated individually. Analysis is well suited to application in energy and transportation fields.

B80-10555
EVALUATING COMPUTER-DRAWN GROUND-COVER MAPS
L. G. ARVANITIS (Univ. of Florida), R. NEWBURNE (Univ. of Florida), and R. REICH (Univ. of Florida)
Apr. 1981 See also NASA-CR-154635(N80-32805)
KSC-11195 **Vol. 5, No. 4, p. 512**
Computer-generated character maps from LANDSAT data are compared to aerial photos for test sites in Florida. Report Describes extraction of ground features by two analytical techniques: unsupervised clustering algorithm, called LANDSAT Signature Development Program (LSDP), and interactive algorithm based on multispectral image analyzer. Study concluded that computer classification of digital LANDSAT multispectral data, supplemented with certain ground-cover information, is valuable tool for analysis of renewable resources.

B80-10556
OCCULT-ORSER COMPLETE CONVERSATIONAL USER-LANGUAGE TRANSLATOR
H. K. RAMAPRIYAN and K. YOUNG (Computer Science Corp.)
Apr. 1981
GSFC-12604 **Vol. 5, No. 4, p. 512**
Translator program (OCCULT) assists non-computer-oriented users in setting up and submitting jobs for complex ORSER system. ORSER is collection of image processing programs for analyzing remotely sensed data. OCCULT is designed for those who would like to use ORSER but cannot justify acquiring and maintaining necessary proficiency in Remote Job Entry Language, Job Control Language, and control-card formats. OCCULT is written in FORTRAN IV and OS Assembler for interactive execution.

B80-10557
SELECTING OPTIMUM ALGORITHMS FOR IMAGE PROCESSING
R. R. JAROE, J. HODGES, R. E. ATKINSON, B. GAGGINI, L. CALLAS, and J. PETERSON
Apr. 1981
M-FS-25367 **Vol. 5, No. 4, p. 513**
Collection of registration, compression, and classification algorithms allows users to evaluate approaches and select best one for particular application. Program includes six registration algorithms, six compression algorithms, and two classification algorithms. Package also includes routines for evaluating effects of processing on image data. Collection is written in FORTRAN IV for batch execution.

B80-10558
A UNIVERSAL STRUCTURED-DESIGN DIAGRAMER
Innovator not given (Higher Order Software, Inc.) Apr. 1981
LANGLEY-12548 **Vol. 5, No. 4, p. 513**
Program (FLOWCHARTER) generates standardized flowcharts and concordances for development and debugging of programs in any language. User describes programming-language grammar, providing syntax rules in Backus-Naur form (BNF), list of semantic rules, and set of concordance rules. Once grammar is described, user supplies only source code of program to be diagrammed. FLOWCHARTER automatically produces flow diagram and concordance. Source code for program is written for PASCAL Release 2 compiler, as distributed by University of Minnesota.

SUBJECT INDEX

Subject Index

The title of each Tech Brief is listed under several selected subject headings to provide the user with a variety of approaches in his search for specific information. The Tech Brief number, e.g., B80-10326, is located under and to the right of the title and is followed by a two-digit number, e.g., 03, which designates the subject category in which the entire entry can be found.

A

C

D

H

J

K

L

M

N

O

P

S

T

U

V

W

X

Y

Z

PERSONAL AUTHOR INDEX

Personal Author Index

This index is arranged alphabetically by author. The Tech Brief title is listed followed by the originating Center number, e.g., GSFC-12327 The Tech Brief number, e.g., B80-10065 is followed by a two-digit number, e.g., 04 which designates the subject category.

A

B

C

K

L

N

O

P

R

ORIGINATING CENTER/TECH BRIEF NUMBER INDEX

Originating Center/Tech Brief Number Index

The left hand column identifies the originating Center number; to the right of each originating Center number is the Tech Brief number, e.g., B80-10248, followed by a two-digit number, e.g., 07, which identifies the subject category containing the entire citation.

Page intentionally left blank

Page intentionally left blank

TECH BRIEF/ORIGINATING CENTER NUMBER INDEX

Tech Brief/Originating Center Number Index

The left hand column identifies the Tech Brief number, e.g., B80-10062, followed by a two-digit number, e.g., 04, which identifies the subject category containing the entire citation. Following the subject category number is the originating Center number.

☆U.S. GOVERNMENT PRINTING OFFICE: 1981—738-109

National Aeronautics and
Space Administration

Washington, D.C.
20546

NASA